SCIENTIFIC AMERICAN

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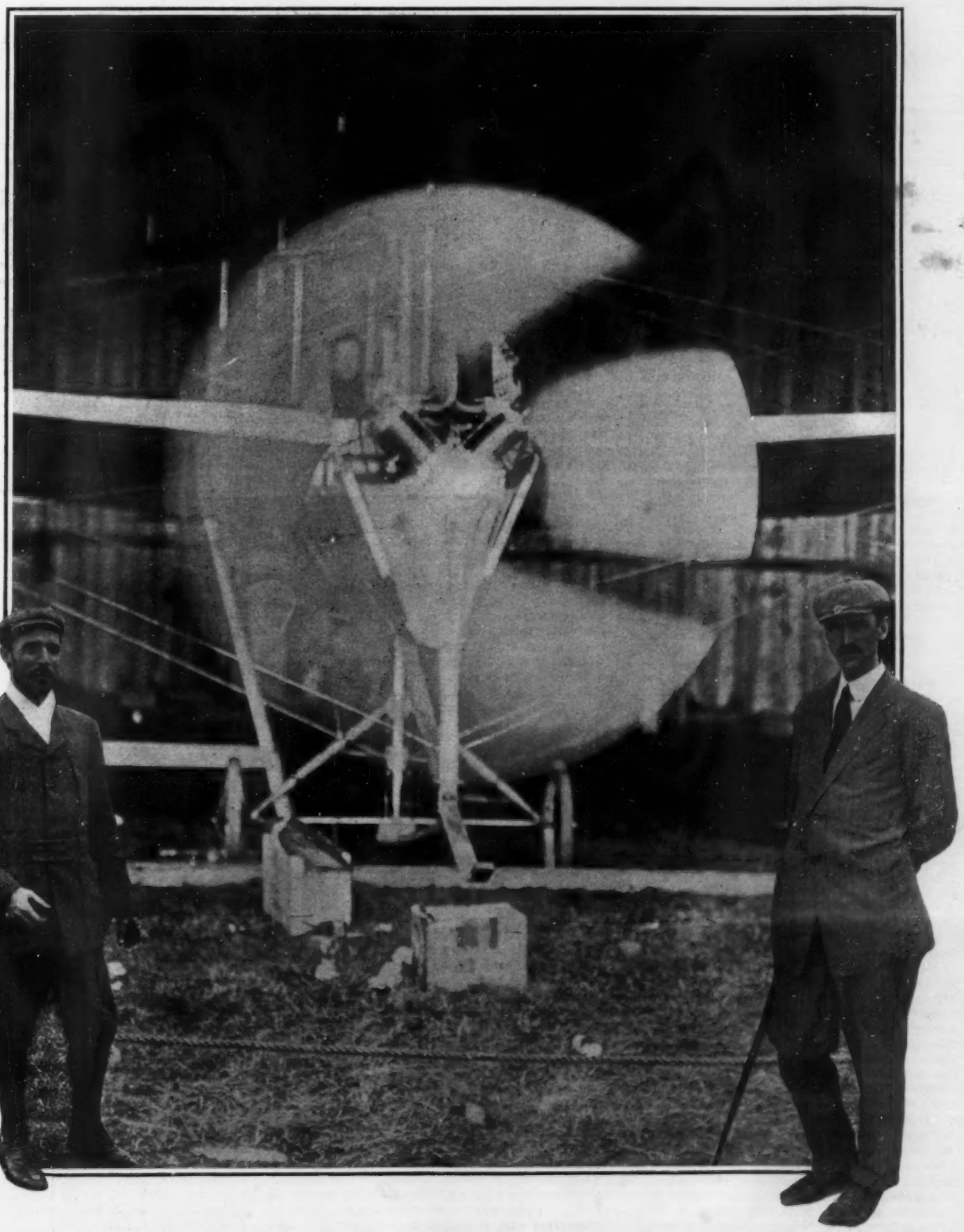
A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CII.—No. 2.
ESTABLISHED 1845.] NEW YORK, JANUARY 8, 1910. [10 CENTS A COPY.
$3.00 A YEAR.



This is the 6½-foot propeller of the Antoinette monoplane revolving at about 1100 revolutions per minute and generating a veritable hurricane. The dark bands are shadows cast on the swiftly revolving blade. Persistence of retinal effect explains the phenomenon.

THE SPEED OF AN AEROPLANE PROPELLER.—[See page 27.]

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ESTABLISHED 1845

MUNN & CO., Inc., - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York.
FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 15s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845) ..... $3.00 a year
Scientific American Supplement (established 1876) ..... 5.00 "
American Homes and Gardens ..... 3.00 "
Scientific American Export Edition (established 1878) ..... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., Inc., 361 Broadway, New York.

NEW YORK, SATURDAY, JANUARY 8th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A NEW ERA OF THE STEAM ENGINE.

IF, in the days of the perfected quadruple-expansion steam engine, anyone had ventured to criticise the type as being very inefficient as a means of extracting the heat energy of the steam that passed through it, he would have been considered as hypercritical, to say the least. And if he had ventured to predict that within a few years, by interposing a certain device between the low-pressure cylinder and the condenser, it would become possible to show an increased economy of from 25 to 35 per cent, and, in some cases, to increase the total horse-power output of an engine by from 70 to 100 per cent, he would have been regarded as a visionary. Yet it is a fact that this doubling of the capacity of an engine has actually been accomplished, as stated in our editorial of December 18th, 1909, describing the remarkable work being done at the Fifty-ninth Street power station of the New York subway system.

It is no exaggeration to state that the low-pressure turbine has introduced an era of improvement in steam-engine practice which is destined to mark an advance in the art, greater than any recorded during the past century of the history of this great prime mover; and we say this with full appreciation of the progress that was made with the introduction of compounding and the later multiple-expansion engines.

A century ago, as we recently showed in our discussion of the low-pressure condensing engines of the time of Robert Fulton, boilers were so weak and steam pressures so low that the condenser was an absolutely necessary accessory. When iron and steel plates became available for boiler manufacture, there was a corresponding rise in steam pressure, which led to a gradual abandonment of the condenser and a tendency to obtain the desired horse-power by working on the higher ranges of pressure. The high-pressure engine exhausting directly to the atmosphere was, of course, an extremely wasteful device, and the invention of the compound engine was logical and inevitable. Then followed the triple and quadruple engines, the limit of expansion being reached when the low-pressure cylinder became too large for practical purposes. If a cylinder were built that would carry the expansion of the steam down to the full theoretical limit of reciprocating-engine efficiency, its dimensions would be exaggerated out of all proportion to the rest of the engine; the weight would be enormous; and the losses through friction, and because of the great radiating surface, would be prohibitive.

The steam turbine, on the other hand, is particularly adapted for accommodating the great expansion of the steam in the lower ranges of pressure, just as the reciprocating engine is better suited for developing the expansion in the higher ranges. The turbine losses in the higher ranges are largely due to the friction of the rapidly revolving blades in the steam at its relatively high density when under high pressure; whereas skin friction is not a serious factor during the expansion of steam in a high-pressure cylinder. At the lower pressures the steam has a small density, and the skin friction losses are inconsiderable. Again, the great drop in temperature in a low-pressure cylinder induces rapid condensation, and greatly reduces the efficiency.

Hence, it will be seen that the reciprocating engine working on the higher ranges of pressure and the turbine working on the lower ranges are the complements, the one of the other, and when acting in combination form an ideally economical arrangement.

The range of application of the new system is wide, and already the turbine is winning back for useful work an enormous amount of heat which was formerly lost in the reversing rolling engine at the steel works, in the winding engines of collieries, and in the power houses of various industrial establishments, where it has become possible to run an addition to the works on the power recovered between cylinder and condenser. The largest steamships in the world, now under construction, will embody the same combination in their engine rooms. In these days of anxiety over the rapid depletion of our natural resources, the auxiliary steam turbine must be welcomed as one of the greatest conservers of our supplies of coal and liquid fuel.

RAPID TRANSIT BY BELT CONVEYER.

BY the action of the Board of Estimate of this city, which, on December 3rd last, passed a resolution authorizing the Public Service Commission to lay out a moving platform subway in Thirty-fourth Street between Second and Ninth Avenues, there will be given an opportunity to test a system of transportation which we have always considered to be ideally adapted for relieving the crowded traffic conditions in congested centers of large cities.

By far the most efficient means of moving material in bulk is the belt conveyer. For transporting material that is in a more or less finely divided condition, or made up of a large number of small separate units, such material, for instance, as grain, coal, or iron ore, the belt conveyer is recognized in the industrial world as having no equal—provided, of course, that the distance to which the material is to be carried and the speed are not excessive.

The moving platform is practically a continuous belt conveyer for the conveyance of a large number of passengers at moderate speed. It consists of short lengths of platform, coupled together, forming an endless chain which is kept in continuous motion. In the Thirty-fourth Street subway there will be four parallel rows of platform; the first, adjoining the station platform, moving at three miles an hour, the next at six miles, the third at nine miles, while the fourth, which will be entirely covered from end to end with seats, will move continuously at twelve miles an hour. Entrances to the moving-platform subway will be placed at every intersecting avenue or street, as the case may be. The capacity will be 73,500 seated passengers per hour in one direction during the rush hour, as against 12,000 seated passengers on the eight-car express train service and 7,500 on the five-car local train service of the subway, and as against 36,000 standing and seated passengers per hour on the express service and 22,500 on the local service.

In a recent communication to the Public Service Commission by its chief engineer, Henry B. Seaman, the advantages of the new system are stated to be: First, a vastly increased capacity and seats for all passengers; second, absence of the delay incurred by waiting for trains at stations, since the train is always there and constantly moving; third, the fact that passengers may board or leave the train at any point at will, and that instead of placing stations one-third of a mile apart, as on the present subway, they may be placed at every cross street, or indeed at any intermediate point. Furthermore, the subway construction may take the form of a continuous arcade, thus providing an additional business front for display and shopping purposes.

Although the moving platform speed of twelve miles per hour may seem somewhat slow as compared with the running speed of a subway train, the difference is not nearly so great as might be supposed, and, indeed, over the shorter distances, is entirely in favor of the new system. The Commission's engineer finds that for all distances of less than four miles the moving platform is a quicker and more convenient mode of conveyance than the local train service, or even quicker than the local and express service combined; a passenger reaching Times Square Station, Forty-second Street, from any local station south of Fourteenth Street quicker by the moving platform than by the local and express trains of the present subway. The local trains ordinarily average, including stops, about fifteen miles per hour, and twelve miles an hour during the rush of traffic. If this rush hour service is compared with a platform speed of twelve miles the platform will have the advantage for all distances, because there is no train interval to wait and no distance between stations to walk.

To our mind the principal difficulty with such a system will be in accustoming passengers to step from one surface to another that is moving three miles an hour faster. Were it not for the great advantage of ample seating accommodation, easy accessibility, and total absence of waiting, to say nothing of the avoidance of the present abominable crowding, one might anticipate some reluctance on the part of the public to make use of so novel a means of conveyance. Experience with escalators, however, would indicate that the public will quickly become familiar with the motion of the platforms. If the new Thirty-fourth Street venture fulfills its promise it will mark a new era in the history of metropolitan rapid transit.

RESULTS OF BRITISH STEAM RAILWAY ELECTRIFICATION.

SIMILAR conditions of heavy operating expenses, congestion of traffic, pollution of the atmosphere by smoke, etc., have led several English railroads to make similar trials of electric traction to those which have attracted so much attention recently in this country. Chief among these are the Mersey Railway, branch lines of the North-Eastern and the Midland, and a section of the London, Brighton and South Coast. Some of these roads have now been sufficiently long under electric operation to afford data for reliable comparison of the relative economies and advantages of operation by steam and by electricity; and the facts which were given at a recent meeting of the Institution of Civil Engineers prove that the adoption of electric traction has been abundantly justified. A comparison of three years' operation of the Mersey Railway under both methods shows that the locomotive and car expenses have been considerably reduced. Furthermore, under steam traction one pound of coal costing sixteen shillings per ton moved one ton 2.21 miles at an average speed of 17¾ miles per hour; whereas under electric traction one pound of coal costing eight shillings and nine pence per ton moved one ton 2.29 miles at an average speed of 22¼ miles per hour. The cost of maintaining the track and roadbed has been reduced from 0.0208 of a penny to 0.0089 of a penny per mile. Under steam traction the rails required renewal after carrying 32 million tons; under electric traction their capacity is 47½ million tons. Furthermore, electrification has raised the average speed on the Mersey Railway, including stops, from 15.6 to 19.9 miles per hour; the number of ton-miles per annum has gone up from 43 to 67 million, and the total expenses per ton-mile, even with the interest on capital cost of the electric installation reckoned in, have been reduced from 0.344 to 0.293 of a penny.

On those branches of the North-Eastern Railway that have been electrified, the train mileage has been doubled, the platform capacity of the main station at Newcastle has been increased, and the number of signal movements has been reduced by one-half. These advantages, coupled with the higher rate of acceleration of the electric trains, have enabled these roads to carry a traffic that would have completely swamped the old steam service.

It is of interest to note that in connection with the electrification of a branch of the Midland Railway, tests which are being made of the relative advantages of direct-current and single-phase operation seem to show that not only is the single phase taking care of the same service as the direct current, but that the weight of the trains is only slightly greater, and the consumption of energy somewhat less. It is to be hoped that our New York Central and New Haven systems, which are operated respectively by the direct and the alternating current, will make public, for purposes of comparison upon a common basis, the results of the past two years of electric operation. If these figures were given, together with the cost of steam operation of these same sections of road, the electrical world would be furnished with a mass of data of exceptional value and interest.

PRIZES AT THE LOS ANGELES AVIATION MEETING.

THE prizes that are to be competed for by heavier-than-air machines at Los Angeles (January 10th to 20th) are the following:

$10,000 for the machine which, carrying two or more persons, breaks all world's records for duration, altitude, distance, and speed.

$7,500 for the machine making the best general average in all events. $5,000 for the machine which breaks all previous records and makes fastest circuit of the course. $5,000 for breaking height record. $5,000 for breaking endurance record.

$500 each for the circuit of least diameter; leaving the ground in the shortest time; shortest distance required in starting; greatest ability during flight (general average); longest glide with motor shut off; best general average in landing at given point. A prize of $1,500 for a machine designed and built by a resident of California, Arizona, or Nevada which flies 5 miles, and one of $500 if a flight of over 2 miles is made. $500 for a machine designed and built in California which flies at least 5 miles. A prize of $2,500 is also offered for a machine that can soar (not glide) without power save that of aviator.

A prize of $10,000 is offered for the dirigible balloon which flies from Los Angeles to San Francisco, and another of $5,000 for a non-stop flight by a dirigible carrying more than 2 passengers from Los Angeles to San Diego and back. The distances are 450 and 150 miles respectively. A $10,000 prize is offered for a balloon trip to the Atlantic coast without a landing, and $5,000 for the first balloon to land east of the Mississippi without touching *en route*. There is a $2,500 prize for breaking Count de la Vaulx's long-distance record of 1,193 miles, and $2,500 more for the first balloon to land within five miles of San Francisco.

ENGINEERING.

There has recently been launched at Bath, Me., the largest wooden vessel ever built in the United States. The "Wyoming," as she has been named, is a six-masted schooner of 3,730 gross tons, with a total length over all of 350 feet. Next to her in size among wooden vessels is the "William L. Douglas," with a gross tonnage of 3,708.

The launch of the battleship "Utah" at the yards of the New York Ship Building Company, Camden, N. J., signalizes, for the time being, the possession by the United States navy of the largest battleship afloat. Both this ship and the "Florida," now being built at the Brooklyn navy yard, are of 21,825 tons displacement, and each will carry ten 12-inch guns.

Toward the close of last year, the four-mile tunnel through the Andes on the line of the new transandine railway between Chili and Argentine was broken through. The tunnel lies on the Chilian side of the boundary line between the two countries, and forms the summit of a new single-track road. It is expected that the tunnel will be completed and the whole line opened in the spring of the present year.

In his annual report to the Secretary of War, Gen. Murray, Chief of the Coast Artillery, announced that the difficult problem of mining the waters of the "race" at the eastern entrance to Long Island Sound has at last been solved. By using anchors of 1,500 pounds weight, mines were successfully anchored at the great depth of 300 feet. A complete submarine equipment for the "race" will soon have been put in place.

The British Congo section of the Cape-to-Cairo Railway, 134 miles in length, was formally opened on December 12th. It extends from the Chartered Company's terminus at Broken Hill to the southern frontier of the Congo Independent State. This completes a continuous British line of 2,147 miles north from Cape Town. Work is in progress on an additional 160 miles, which will probably be completed in the autumn of 1910.

The "Vanguard" of the British navy, which has now undergone her trials with a maximum high-power speed of a fraction under 22 knots, is the fourth dreadnought to be completed for the British navy. Her displacement is 19,250 tons. She carries ten 12-inch guns disposed similarly to those of the original "Dreadnought"; that is, with six on the center line, and two on either broadside. On the full-power trial the coal consumption per shaft horse-power was 1.63 pounds, and the main steam consumption was less than 14 pounds, per shaft horse-power per hour.

The United States Engineer Corps are engaged in surveying the route of the proposed Atlantic Coast Canal from Boston, Mass., to Key West, Fla. The scheme calls for a canal from Boston to the coast; through Long Island Sound, to and across New York Bay; thence across New Jersey to the Delaware River; thence to Norfolk on Chesapeake Bay, and thence to the sounds of North Carolina and Beaufort Inlet. The law providing for this survey calls for surveys for a 25-foot ship canal from Boston to Beaufort, and a 12-foot canal from Beaufort to Key West. The estimated cost is $100,000,000.

To facilitate traffic across the huge Culebra cut, and to carry certain air and water mains, a highway suspension bridge, with a span of 600 feet, has been built across the cut at Empire. Most of the material for the bridge was found on hand at Panama. The stiffening truss was made up of 4 x 6 and 6 x 6 timber; and the towers were built up of 6 x 12 and 5 x 10 creosoted pine timber bolted up in 16-foot lengths. The main cables, 870 feet in length, are 2¾ inches in diameter and have each a tensile strength of 170,000 pounds to the square inch.

The managements of several railroads have followed the lead of James J. Hill in impressing upon the farmers the need for conservation of the fertility of the soil, and they are using for this purpose the demonstration train. One of the latest of these, equipped by the Pennsylvania State College, is being operated on a division of the Pennsylvania lines, and other instruction cars are following a route through Iowa and Nebraska. The return to the railroads for the outlay for this enterprise will consist in the increased amount of freight brought to their lines as the result of more intelligent farming.

The introduction of the articulated compound type has made it possible for the railroads to greatly increase the effectiveness of existing locomotives which have become unequal to the work demanded. The Baldwin Locomotive Works have recently enlarged a consolidation engine for the Great Northern Railway by extending the boiler shell to include a superheater and feed-water heater, and placing beneath the extension a separate low-pressure six-coupled engine. It is estimated that the coal consumption per ton mile will be reduced by nearly 50 per cent; 10 per cent being due to superheating, 15 per cent to feed-water heating, and 25 per cent to compounding.

ELECTRICITY.

The Nobel prize for physics has been divided this year, one-half being given to Guglielmo Marconi for his development of wireless telegraphy, and the other half to Prof. F. K. Braun of Strasburg University, Germany, for his work in radio-activity.

Experiments are under way to establish wireless telegraph communication between Japan and San Francisco by way of Hawaii. Also to telegraph direct from Japan to San Francisco. So far these efforts have been unsuccessful, although telegrams have been received in Japan from Hawaii. However, the transmission was too uncertain to be of any commercial value.

The scout cruisers "Birmingham" and "Salem" were sent recently on a cruise to test the efficiency of their wireless telegraph system and that of the station at Brant Rock, Mass. The cruisers were to attempt to maintain communication with each other over a distance of a thousand miles, and with the land station over a distance of three thousand miles. Owing to severe storms, the test was not very successful. Doubtless further tests soon will be undertaken under more favorable conditions.

A new steam-electric locomotive is being built in England. It comprises a steam turbine, which operates a dynamo supplying current for four series-wound motors. The engine is being designed to haul express trains, and will be tested in actual service so as to show its efficiency as compared with the ordinary steam locomotive. It is pointed out that turbo generators have proved so efficient in stationary plants that a similar system would very probably prove to be of value on railways to replace steam locomotives.

A writer in Engineering (London) calls attention to the water power of Iceland which is going to waste. A company is now being formed to exploit these power resources. The Skjälfandi River Falls comprise the Goda Falls with 39,200 horse-power, the Aldeyjar Falls with 35,800 horse-power, the Barma Falls with 17,000 horse-power. The Laxau River Falls would produce 30,000 horse-power, the Sog Falls 50,000 to 70,000 horse-power, and the Guldfoss Falls 100,000 horse-power. With all this hydraulic power available, Iceland would seem to be an ideal spot for the generation of electricity, particularly for use in electro-chemical industries.

A press report from England speaks of a remarkable development in wireless telephony, which will make it possible within a few weeks to carry on conversation between Paris and New York. As the record distance over which wireless telephonic conversation has been held even under the most favorable conditions is but a hundred miles or so, it is impossible to believe the press dispatch. It is very difficult to telegraph over so great a distance, and as the developments in wireless telephony are in their infancy, and far short of those in wireless telegraphy, it is probable that we will have to wait many years before conversation can actually be maintained between the cities named.

A new type of car has been built for a line in Brunswick, Ga., in which the conductor is eliminated. The cars are of the "pay-as-you-enter" type, but may be entered only from the front platform, where the fare is deposited in the cash box under the motorman's eye. The cash box is provided with a glass receiver, in which the fares may be examined before being dropped from the tilting bottom into a locked cash drawer. The cash box must be moved to the other platform when the car is on its return trip, and this has made it necessary to provide certain precautions to prevent coins from dropping out in case the box is turned upside down, and to lock the cash drawer when the box is removed from the support. The box is also provided with a fare-counting machine.

An interesting comparison of the New York and Paris subway systems was published in a recent number of the Electric Railway Journal. The following conclusions were reached: In the Paris system the average fare is but 2.7 cents with a minimum fare of 1.19 cents at certain hours of the day. The Paris system offers universal transfers over a complicated network of lines, and when this network is completed a passenger may travel from any quarter of the city proper to any other quarter for a single fare. Our own system on the other hand charges a much higher fare, though the possible ride is longer. Allowing for difference in purchasing power of money, the charge per mile for the average ride is from one and one-half to two times as great in Paris as in New York. The lines extend into undeveloped areas fourteen miles from the center of traffic as against three or four miles in Paris, and a greater speed is attainable. The average speed in Paris is but twelve miles per hour, while in New York on the express tracks between the Brooklyn Bridge and 96th Street the rate is twenty-four miles an hour including stops, while the average speed for both express and local trains for the entire system is eighteen miles per hour.

SCIENCE.

Former President Roosevelt's African hunting trip will result in enlarging the Smithsonian collection by 6,663 skins. The collection consists of hides of 243 large mammals, 1,500 small mammals, and 1,356 stuffed birds. Human skulls picked up along the line of the ancient slave trail are also included.

Prof. Hergesell, Count von Zeppelin's mathematical and meteorological adviser, is now in New York. He states that two airships will be used by Count von Zeppelin with a view to exploring the entire region within the Arctic Circle. One will probably be left at a relief station in Spitzbergen, while the other is on its journeys, the two keeping in touch by means of wireless telegraphy. The German government will undoubtedly aid the undertaking financially.

Charcoal, graphite, and diamonds are only different forms of one chemical element—carbon. Hitherto carbon has been regarded as infusible, but it has apparently been fused in experiments which were described by the Italian physicist La Rosa, at the last international congress of applied chemistry. By subjecting very pure sugar charcoal to the intense heat of the singing electric arc, La Rosa obtained a compact mass of graphite. When this mass was cooled quickly, minute transparent crystals appeared, which were proved to be diamonds by their form, chemical composition, and physical properties.

Dr. W. von Oechelhaeuser has invented a method of converting ordinary coal gas into a very light gas which is eminently suitable for filling balloons. The process consists in decomposing and removing all of the heavy hydro-carbons and nearly all of the methane, and converting the carbon dioxide into the lighter carbon-monoxide. The resultant product is an almost odorless gas which contains more than 80 per cent of hydrogen and has a density of 0.225. The density of ordinary coal gas is 0.41 and that of pure hydrogen is 0.067. The lifting power of the new gas is about one ounce avoirdupois per cubic foot; the buoyancy of coal gas is 0.7 ounce; and that of commercial hydrogen is 1.1 ounce per cubic foot. The balloon of the Aeronautical Society of Anhalt is to be filled with the new gas.

A kitten about six months old was taken to a house a few miles distant from its birthplace, confined in a room and tenderly cared for during a week, and then set at liberty. It was supposed to have become habituated to its new surroundings, but it returned to its old home on the day of its release. The sense of locality and direction was exhibited still more strikingly by an old tom cat, which was stolen and carried a distance of 20 miles, confined in a bag. The cat was imprisoned, but made its escape and in a few days reappeared in a pitiable state at the home of its former master, which was separated from that of the thief by a high wooded cliff.

A writer in Kosmos states that he possesses a tame magpie, to which he sportively offered an extinguished cigar stump. The bird began to tear the stump apart but, apparently changing its mind, proceeded to nib the stump, held in its beak, over every part of its body, including the inside of the wings, in a very careful and methodical manner. The experiment was subsequently repeated many times, always with the same result. The magpie is so fond of tobacco that it has repeatedly snatched a lighted cigar from his hand, against his will. It also picks up fallen cigar ashes and strews them over its feathers. He thinks these actions have a purpose, the destruction of parasites, and are determined by atavism or inherited instinct. In the wild state, some unidentified plant must have been used, instead of tobacco, as an insecticide. The magpie's action, furthermore, seems to be an unquestionable instance of the use of "tools" by a lower animal.

A great number of elements was studied by Madame Curie, but, with the exceptions of radium, uranium, and thorium, she found no elementary substance possessed of a radio-activity greater than one one-hundredth of that of metallic uranium. Campbell made a similar series of examinations by a more sensitive method and came to the conclusion that potassium, rubidium, and lead are radio-active; but Elster and Geitel have traced the radio-activity observed in lead to a small admixture of radium F, i. e., polonium. Levin and Ruer have recently tested the radio-activity of a great many substances. Their experiments confirm Campbell's results in regard to the radio-activity of potassium and rubidium. This radio-activity, however, is very small, being, in the case of potassium, only 1/1,000 of the activity of the β radiation of uranium oxide. In this case the radio-activity cannot be attributed to impurity, as the potassium compounds examined were derived from many different sources. They included commercial compounds, potash salts obtained from molasses, distillery wastes and wool washings, Stassfurt potash rock, etc. One specimen was obtained from the ashes of Russian sunflowers, a second came from the Tyrol and the third from Chile.

A UNIVERSAL VISE.

BY JACQUES BOYER.

Vises usually occupy fixed positions, and serve merely as clamps by which the wood or other material is prevented from moving, while the workman is compelled to adapt the position of his tools and his body to circumstances, as best he may. The ordinary vise, no matter what the purpose for which it is designed, consists of two jaws, one fixed, the other movable. The latter is moved toward and away from the former by a strong, square-threaded screw, which turns in a nut in the fixed jaw and in a collar in the movable jaw, and the movement is opposed by a flat spring, which takes up the lost motion.

The universal vise, invented by P. Gloagnen, is mounted on a ball and socket joint which allows it, and the object held by it, to be turned in any direction, so that the work can be done more conveniently and in a favorable light. When the vise has been set in the desired position the ball and socket joint is locked and held motionless by a double-jointed jaw, operated by a strap terminating in a loop, in which the workman's foot is placed.

As the accompanying photograph indicates, the universal vise is designed primarily for the use of shoemakers. It can be employed with advantage in shaping, sewing, nailing and almost every other operation involved in the making and repairing of shoes. The shoe and the standard which carries it can be turned into any position and instantly immobilized, without touching the screw of the vise, so that shaping can be done much better than is possible with a rotating vertical standard, as the sole and the heel can be placed in the positions most favorable for working.

The apparatus is very simple and comprises only five large parts and two pins.

THE UNIVERSAI VISE.

The Pacific coast lumber manufacturers have taken the initiative in an important step for the promotion of proper and conservative use of their timber supply. Practically all of the large manufacturers of lumber in the States of Oregon and Washington have entered into an agreement to manufacture odd as well as even lengths in flooring, finish, and similar planing-mill products. Heretofore it has been customary to manufacture these products in even lengths only. Now it is proposed to trim the manufactured lumber to lengths of odd numbers as well as even numbers of feet. Under the old system a considerable portion of the lumber which came to the shaping machine was wasted, and this action has been taken in order to save that waste. Considerable opposition to this innovation has arisen among retailers and consumers. The retailer contends that it is impossible for him to dispose of odd-length material, because of the common practice in the construction of wooden buildings, claiming that the initial saving of the manufacturer is transferred to the consumer. This is denied, however, because of the proportionally small amount of odd-length material which will occur under the new system, and because of the latter-day practice of laying sub-floors of rough lumber and sheathing on the sides of the house before putting the finishing material in place. Because of the conservation element which enters into this question, the United States Forest Service has been recommending the adoption of odd lengths for some time past. The Portland office of the Service has recently made an investigation of the actual amount of unnecessary waste incident to the manufacture of even lengths only, and these figures show that under the old system the refuse burner consumed about two per cent of the total amount of the important forms of planing-mill products which are manufactured from Douglas fir and other important forest species, in the States of Oregon and Washington. When it is considered that about 750,000,000 feet of planing-mill products are manufactured annually in the two States mentioned above, this two per cent assumes important proportions. The Forest Service is authority for the statement that 15,000,000 board feet of high-pric[illegible] lumber can be saved annually [illegible]n Oregon and Washington by the manufacture of planing-mill products into lengths of odd feet as well as even. It would require the yearly growth of timber on approximately 30,000 acres of average timber land to produce the amount of lumber which this annual waste represents. The manufacturer is convinced that the waste is unnecessary. His greatest trouble now lies with a similar conviction on the part of the consumer that odd lengths can be used as economically as even lengths.

The new Mexican-Pan-American Railway has already been opened, states the American Machinist, and the line is in active operation from San Jeronimo on the Tehuantepec Railway to Tapachula, in Chiapas. The extension of that line will be continued to Port San Benito on the Pacific coast. There is also planned a new railway, passing through parts of the States of Coahuila and Chihuahua, about 375 miles long.

MECHANICAL BOWLING MACHINE.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Numerous efforts have been made from time to time to devise a mechanical apparatus for reproducing human action in the delivery of a ball in various games where such is required, such as baseball, cricket, tennis, and so forth. The problem however is somewhat abstruse, inasmuch as in bowling success is largely dependent upon the brains of the bowler, who resorts to varying subterfuges to nonplus his opponent, such as varying the pace, swerve, and "break" of the ball while in the air or after it has struck the ground. To reproduce these peculiarities by mechanical effort is no easy matter, but an English engineer, Mr. D. D. Esson, M.I.M.E., of Birmingham, has perfected an ingenious device for fulfilling the desired purpose.

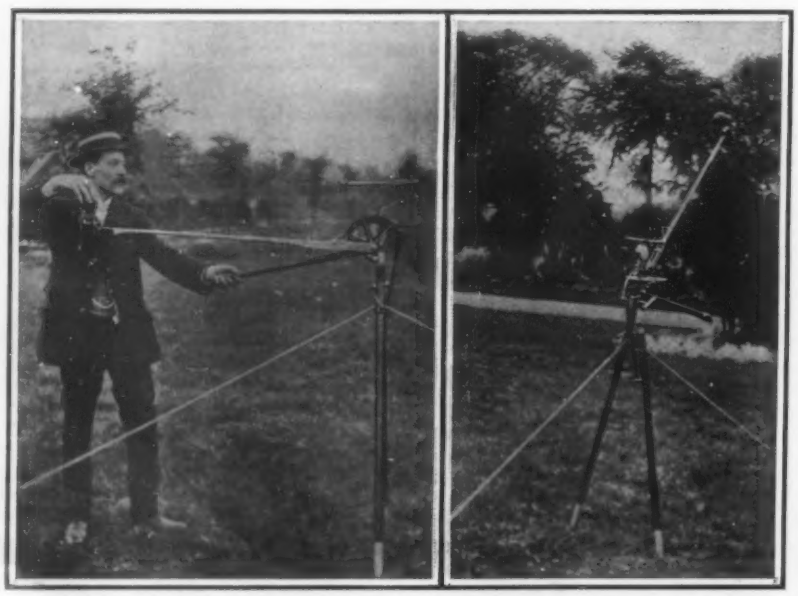
As may be seen, the apparatus comprises a tripod of steel tubing, firmly fixed to the ground by means of specially designed anchors, which correspond to the "body" of the bowler. The ball rests freely in a semi-spherical cup or "hand" carried at the outer end of a lever about the length of the human arm, with which it corresponds, the lower end of this lever being pivoted to the "body" at the "shoulder."

When the machine is at rest, the arm remains in a vertical position, and the bowling operation is produced by pressing this arm backward into a horizontal position, with the ball resting in the cup-shaped hand. Directly the arm is released it flies toward its normal position, describing therein a quarter of a circle, the ball being propelled through the air with varying velocity as desired toward its objective. This forward movement of the moving arm is produced by the action of a strong spiral spring, one end of which is attached to the moving lever a short distance above the shoulder, while the other end is attached to the body by an adjustable tightening screw. By means of this screw the momentum imparted to the arm, and consequently the velocity of the ball, can be regulated merely by altering the tension of the spiral spring.

A ball delivered in this manner, though fast or slow according to variation of spring tension, is a straightforward delivery—it possesses none of that swerve, spin, or gyration causing it to break to the right or left when coming into contact with the ground, and which is so baffling to the batsman. This requirement is fulfilled in an ingenious manner. The center of the cup-shaped receptacle or palm of the mechanical hand has a roller or drum with its axis running transversely with the bottom of the cup, and having its periphery projecting slightly above the spherical surface of the palm, so that when the ball is inserted, it rests upon this drum. The cup itself is fixed into a box-shaped casting of such dimensions that the external diameter of the cup will fit against the four internal sides of its containing box. Attached to the base of this outer box, and at right angles therewith, is a hollow spindle or tube, mounted on a bearing which is rigid with the end of the arm, and in which it can be revolved. It will be observed, however, that the axle on which the drum revolves is at right angles with the hollow spindle on which the box and cup are mounted, the spindle itself being set at right angles with the ball's trajectory. This spindle has a groove over which passes a band, the ends of which lead down a recess in the arm to within a short distance of its pivot with the body, and then the band is carried at a tangent over guide pulleys, one on each side, and the ends secured to brackets on either side, sufficiently far apart to enable the arm to swing uninterruptedly.

When the arm is released from its horizontal position, and is pulled forward by the spring, the hand, by reason of the spindle's rotating, is caused to revolve, so that the velocity thus imparted to the ball, simultaneously with the cen-

(*Concluded on page 25.*)



Inserting the ball in the "hand" of the machine.

The machine in the act of throwing the ball.

A MECHANICAL BOWLING MACHINE.

AN AUTOMATIC RAILWAY SAFETY STOP.

BY DR. ALFRED GRADENWITZ

Since the terrible catastrophe on the Berlin Elevated and Underground Railway caused by a train running by a stopping signal, the German railway administrations have been giving increased attention to automatic braking devices for preventing the recurrence of such accidents. The apparatus illustrated in the accompanying figures has been adopted provisionally, and is now being tested out. Its object is to warn the engineer and fireman by visible and sound signals and set the brakes, all being done simultaneously.

The safety device consists of contact levers mounted on the locomotive, and pedal contacts arranged on the track. The former are always arranged on the right-hand side of the engine, and are actuated by a permanently tightened spiral spring. In the interior of the cab is arranged in a conspicuous position the repeating box, which is intended for indicating to the driver: (1) whether the track is disengaged; (2) which signal has been passed over; or (3) that the apparatus is out of order, the various indications being signaled on a red background inside a white frame, immediately before the engineer's eyes.

Above this repeating box is arranged a recording box, which mainly contains a clockwork, which is actuated if the train runs by some signal. This clockwork sets a roller and paper tape rotating and thus causes a dash or dot to be inscribed. Furthermore, the engine driver is free to produce, on the same paper tape, before passing the signal, an annular mark, showing the signal to have been duly attended to. These marks may serve as useful records in the case of law-suits.

On the roof of the driver's stand is mounted an alarm siren, the howling sound of which is readily distinguished from that of ordinary locomotive whistles. The same siren is used as a braking signal in the case of brakeless goods trains. On the running board of the locomotive is arranged the brake-cock casing 5, containing, in addition to the brake-cock, a click for tightening the spring above mentioned, and, accordingly, the whole apparatus. This click, in turn, is connected through the draw-bar 10 with the contact levers 6. These two contact levers 6 on sliding over the contacts pull downward the draw-bar 10 and thus set the apparatus working. The apparatus is actuated only in the event of both levers being struck simultaneously. This arrangement thus insures thorough reliability of operation.

At each distant signal there is arranged a single pair of track contacts, and at the main signal, two pairs, situated about 30 meters apart. They are so connected with the signals as to be lifted when the signal is closed, thus protruding beyond the rail head and coming into contact with the sliding levers of the locomotive, whereas, in the event of the signal being drawn, they are located below the rail head, so as to avoid any contact.

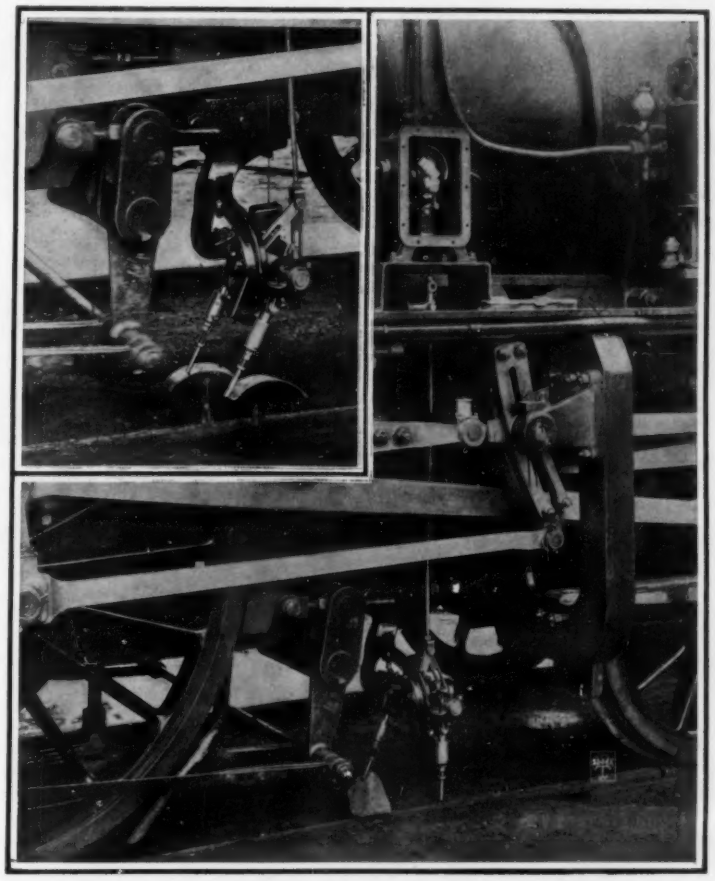
In addition to these stationary pedals movable pedals are provided which are readily fitted behind fish-plates, with a view to warn and stop trains at any point of the track.

The working of the apparatus is as follows: On the contact levers passing over the track contacts, the draw-bar 10 is pulled down, thus disengaging the click. The apparatus is merely operated by the spiral spring, and as the contact levers perform no work outside of disengaging the tightening apparatus, any heavy shocks are prevented, and the wear and tear is reduced considerably.

On passing over a distant signal, the contact levers strike only a single pair of pedals situated on the track, thus closing an electric circuit, by the action of which the alarm siren is sounded, while a disk bearing the inscription "distant signal" appears in the cab signal box, and a dash is marked on the paper tape in the repeating box. The brake cock is opened at the same time and the train is stopped automatically. Owing to the automatic disengagement of the brakes, the driver is in a position himself to throw the apparatus out of gear, and to continue his journey.

On a closed main signal being passed over, the contact with the first pair of pedals produces an effect, as above stated, during a very short time, which effect is reinforced immediately by the second pair of track contacts. In fact, this second contact further disengages the click, thus opening completely the braking cock and producing a rapid braking. At the repeating box appears a disk with the inscription "main signal," while at the same time a dot is marked in the recording box. In addition to this, a checking lead is broken. The second contact also causes the apparatus to become locked up, so that the engine driver is no longer in a position himself to throw the apparatus out of gear, before the train guard has re-

(Continued on page 35.)



Upper engraving shows contact apparatus in operation. The lower engraving shows contact of single lever without effect.

Tripping devices in operation.

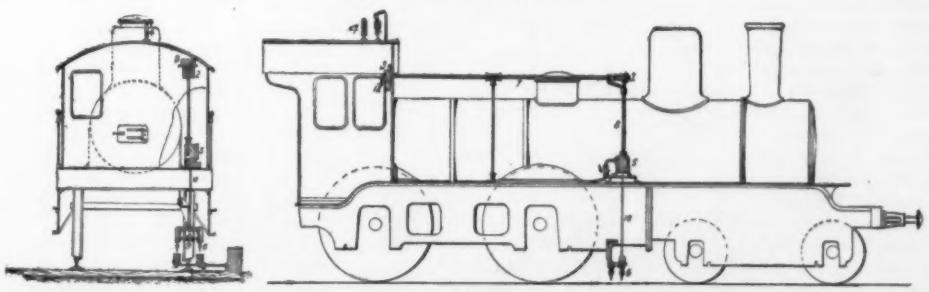
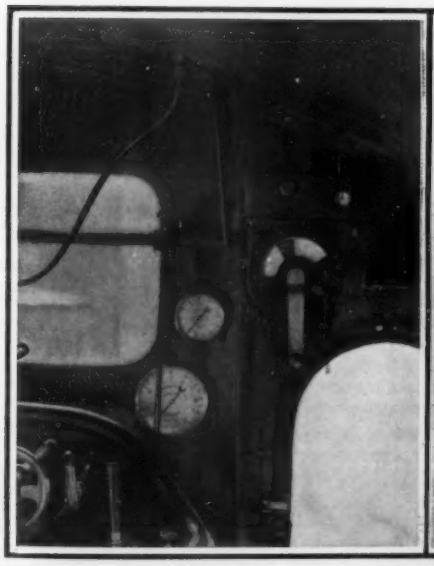
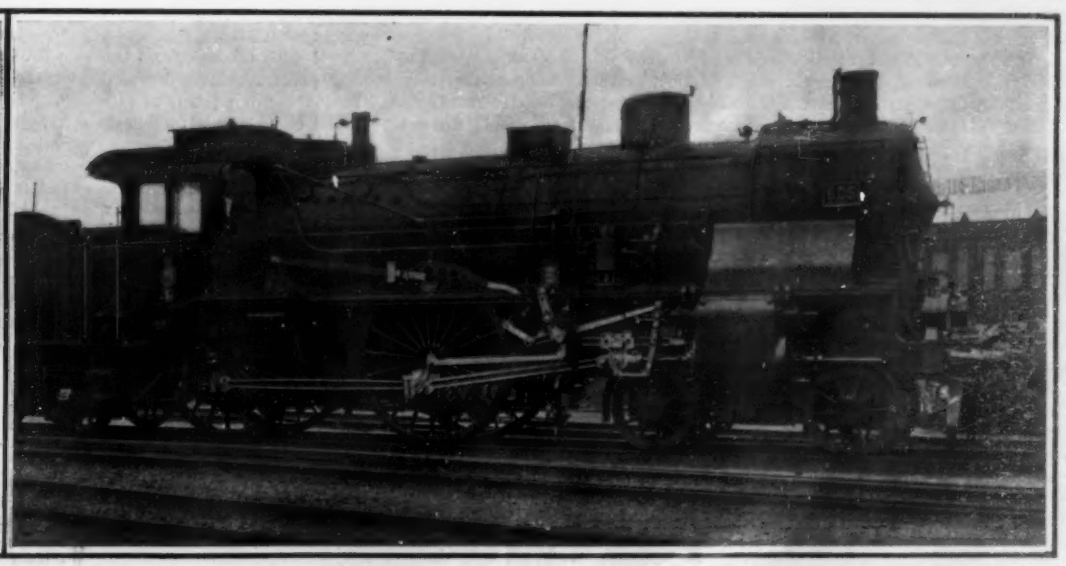


Diagram showing arrangement of track and engine contacts, and connections to sight and sound warning devices in cab.



Engineer's side of cab, showing repeating and recording boxes.



If the engine runs past a danger signal, track contacts display a signal in the cab and blow a warning whistle.

Express locomotive fitted with automatic safety devices.

AN AUTOMATIC RAILWAY SAFETY STOP.

FRICTION AT RAILWAY CURVES.

BY J. F. SPRINGER.

When two material surfaces are in contact with each other, there are two distinct methods of withdrawing points of contact from each other. Consider such points to be extremely small plane areas. Thus, let Fig. 1 represent a highly magnified sectional view of two contacting points. *AB* represents the infinitesimal plane area. (First) The surfaces may be withdrawn from each other by moving *C* or *D* (or both simultaneously) in a direction perpendicular to the plane represented by *AB*. This gives rise to what is termed *rolling friction*. (Second) Withdrawal may be effected by moving *C* or *D* (or both simultaneously) in any one of the directions lying in the plane represented by *AB*. Thus, the movement may be along *AB*. The direction is immaterial, provided it is in the tiny plane of contact. This method of withdrawal gives rise to *sliding friction*.

Now material surfaces are not perfectly smooth. When in contact under pressure, the projecting particles interlock with each other—as idealized in Fig. 2. It can readily be seen that movement in the directions *G*, *H* would tend to shear off the large projections 1, 2, 3, 4; while movement in the directions *E*, *F* would tend to shear off merely the interlocking protuberances of the large projections. That is to say, sliding friction involves abrasion of the principal projections, while rolling friction relates merely to projections on projections. Consequently, it is not difficult to comprehend that sliding and rolling frictions belong to different orders of magnitude. In fact, the one kind of friction is a most important consideration in mechanical engineering, while the other is usually negligible.

It is easily seen that the movement along *AB* produces what we all understand by sliding friction, but perhaps some may hesitate at considering perpendicular withdrawal as rolling friction. Consider Fig. 3. Here the wheel is rolled in the direction given by the arrow *C*. The removal of the points contacting at *A* is effected by the change of the instantaneous center of rotation from *AA'* to the next point *BB'*. [See article "Some Principles of Ball Bearing Design" in Scientific American for November 6th, 1909.] In making this change, *A* moves perpendicularly away from *A'*. Likewise *B* approaches *B'* perpendicularly. And so on throughout the roll—the points of contact approach and recede from each other perpendicularly to the surfaces of contact.

Now it will not be very hard to see that any movement of withdrawal that is *oblique* is really a compound of the perpendicular and parallel movements. We may provisionally assume that in so far as it is perpendicular it is a rolling friction; and that in so far as it is parallel it is a sliding one. That there are such compound frictions may be seen by consulting the article to which reference has already been made.

Now two very important economic questions arise in connection with friction. First, friction *wears* the contacting parts. This is a matter of very considerable significance. Second, friction consumes *power* in performing this abrasion. In some cases, this becomes a matter of still greater importance. However, they go hand in hand—useless destruction of material and waste of the power used in accomplishing this destruction.

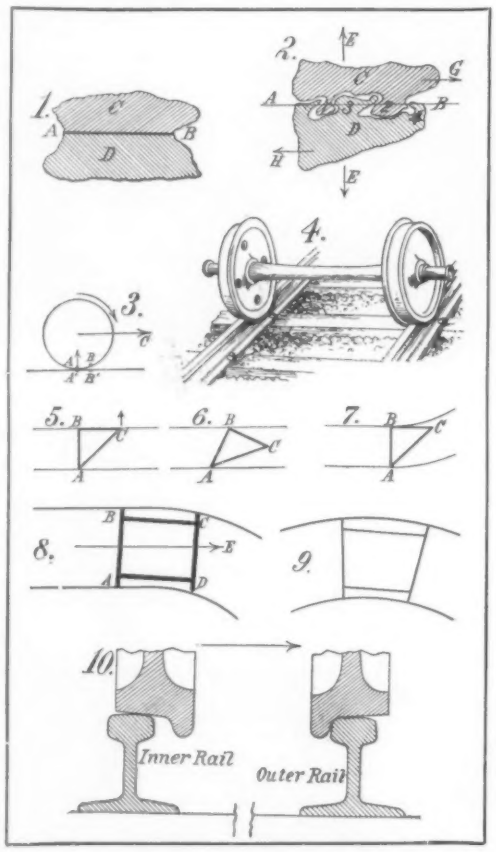
These two factors have, perhaps, been more or less recognized almost from the beginning of the age of machinery. But it is only in comparatively recent years that their vital importance has begun to come to the fore. In every direction in the machine world this is testified to at the present time by the introduction of ball and roller bearings. These serve—with more or less perfection—to accomplish the exchange of sliding for rolling friction. In the railway world, the antifriction movement is attested by the fact that large outlays are being made to eliminate the friction at curves. Reduction of time is no doubt also in view. But the railroads certainly have in view the economic gain to be derived from the avoidance of that excessive wear on rail and wheel which occurs when rounding a curve, and the money advantage in saving the steam power wasted in effecting the wear and tear.

That railway curves give rise to a very excessive amount of friction may be understood from the amount of wear occurring at a certain curve in the "subway" of the Boston Elevated Railway. Carbon-steel rails were replaced at a certain point, on the average, every forty-four days. The amount of wearing down on the heads of these rails was about three-quarters of an inch. As to what happened to the wheels in accomplishing this wear, no one has any exact information. But it must have been very considerable. Three-quarters of an inch was not worn off the rail head without a corresponding effect on the wheels and trucks.

What happened at this curve is happening, in greater or less degree, upon all curves, wherever located. It is a matter of interest and importance, then, to consider more particularly the causes of friction at railway curves.

Three prominent factors enter. The first causal factor arises out of two facts. The outer rail of a curved track is longer than the inner one. And yet the one must be covered in the same time as the other. Then car wheels and axles are so combined that two wheels and the corresponding axle operate as a single piece. Consequently, the one wheel is compelled to rotate at precisely the same speed as the other. In rounding a curve, however, a greater distance is covered by the one. This conflict of rotational velocities between the two wheels results in slippage, and this of course means wear of metal and loss of power. It is to be observed that this friction occurs irrespective of the speed of the train. For the difference in length of rail between the two sides of the track remains precisely the same, and this controls the amount of slippage. The seriousness of the friction is accentuated, however, by the speed.

It has been proposed so to arrange the wheels and axle that this slippage could not occur. This might be done in two ways. Both wheels might be rotatably mounted, the axle being kept "dead"; or, the one



FRICTION AT RAILWAY CURVES.

wheel might be made integral with the axle, and the other rotatably mounted. That either method would be effective can scarcely be doubted, but practical railroad people do not seem to take kindly to wheels mounted rotatably on an axle.

Whether they are justified or not, there is another friction factor which enters and which is of far greater weight. In order to get this clearly before the mind it will be well, perhaps, to consider the action of a group of flanged wheels on a railway track. Suppose we take a single pair of wheels and the corresponding axle. These wheels are flanged on the inside, as in Fig. 4. Now it will readily be granted that the axle *must* be kept perpendicular to the direction of the rails. In the case of the single pair of wheels, how will this be maintained? The two planes of the flanges at the places of contact with the inside of the head of the rail no doubt give some assistance. But this is practically negligible for the reason that a tight fit is not permissible. In fact, a very slight disturbance would be competent to destroy the perpendicularity of the axle, even on a straight track.

Consequently, some additional means must be utilized. If we attempt to solve this problem by constructing a truck of *three* wheels, all being maintained unalterable in their relative position to each other, we should not succeed. In Fig. 5, the triangle *ABC* represents such an arrangement, the wheel contacts being supposed to be at the vertices *A*, *B*, and *C*. This truck would no doubt withstand any tendency operating to throw it in the direction of the arrow at *C*. But a tendency in the opposite direction would give rise to the situation in Fig. 6. If at no other time, such a tendency would arise at a curve in the track when the rail corresponding to *BC* tended away from the truck as a whole. This condition of affairs is represented in Fig. 7.

The lowest number of wheels which when combined in a truck are competent to maintain themselves upon a track is *four*. The four-wheeled truck is consequently the unit that must be dealt with in considering the friction arising at curves.

Now when such a truck rounds a curve, the outer wheel of the forward axle is the one which first meets the change of direction. This is shown in Fig. 8, where the wheel at *C* has begun to respond to the curvature. The wheel at *D*, because the rail curves away from it, will tend to be relieved. The impetus of the truck is in the direction *E*. Consequently, there is a severe grind at *C*. And this condition obtains throughout the curve.

No doubt if, during the time of rounding the curve, the axles of the truck could always lie in radii of the curve, as shown in Fig. 9, the friction arising from the rigidity of the truck formation would be largely reduced, if not entirely eliminated. Inventors seeking to attack this problem must remember that the arrangement of the truck cannot be flexible. The change from the rectangular form to that of the isosceles trapezoid must be sufficiently instantaneous. It must not go further than requirements demand. Further, conditions must be reversible for curves bending in the opposite direction. Altogether, this is a very pretty problem.

Another factor which enters is one pointed out by Mr. Edward Godfrey. The tread of the wheel is not horizontal, but inclined, as in Fig. 10. On the outside wheel of the forward axle the climbing tendency resulting from the effort of the truck to move in a straight line forces the wheel flange to some such position as that shown in the figure. This is aided, no doubt, by the fact that thus greater speed is attained. Reverse conditions on the inner side of the curve cooperate to the slewing of the whole axle outward, because thus a less speed is obtained on the inner side of the truck. Now the result of this slewing is to bring a very steep portion of the outer wheel in contact with the head of the rail. There arises, thus, a severe wedge action. This is, perhaps, the most important of all the factors giving rise to friction at curves. It is due to a combination of the causes producing the other two.

Death of William A. Eddy.

William A. Eddy, well known throughout the country for his many kite-flying experiments, died recently after an illness of several months. Mr. Eddy's life was spent in the study of kite flying, to which art he contributed much that is valuable. Although a self-taught man, he did much useful work, particularly in kite photography. Latterly he was very much interested in aeronautics, to which his kite investigations naturally drew him.

Dr. Czerkis of Vienna, who has undertaken a study of the chemical structure of cannabinol, the active principle of hashish or Indian hemp, gives the following graphic description of the peculiar intoxication which hashish produces: "It is as if the sun illuminated every thought that passes through the brain, and every bodily movement is a source of joy. The hashish eater does not experience the kind of pleasure which is produced by the gratification of bodily appetites. He feels the joy of one who hears good news, of the miser counting his gold, of the lucky gambler, or the successful seeker after fame. He is the sport of every impulse and the current of his thought is diverted by the slightest impression. A word or a gesture suffices to suggest new images and ideas, with marvelous quickness and precision. For this reason the Oriental hashish eater, before he gives himself up to the enjoyment of the drug, takes care to remove from his presence everything that could induce melancholy or any feeling except that of keen delight. For the accomplishment of this object he makes use of every means which the customs of the Orient place at his disposal. In his harem, surrounded by his wives, under the spell of soft music and voluptuous dances, he enjoys a delirium in which he feels himself transported to the paradise which the prophet has prepared for him."

THE SPEED OF AN AEROPLANE PROPELLER.

The idea of propelling a huge machine weighing half a ton at the speed of an express train by means of a fan seems absurd on the face of it. One is apt to discount the power of a fan. Air is such an intangible, imponderable, substanceless fluid, that it seems impossible to obtain sufficient thrust against it to drive a machine of any appreciable weight. Yet this is what a flying machine propeller must do. The result is obtained by making the propeller of such size and driving it at such speed that when the machine is held stationary, the propeller will generate a current of air flowing at the rate of a hurricane. We know something about the power of heavy gales; and when we consider that an aeroplane propeller is capable of producing a moderate-sized cyclone, it is easier to conceive of its exerting sufficient force to drive a 1,000-pound aeroplane at a fast clip. Flying machines have attained a speed of over fifty miles per hour. In order to do this, the propellers must have been driven fast enough to have produced a current of air considerably more than this velocity, because the fluidity and elasticity of the air is sufficient to cause a considerable "slip" of the propellers, which reduces their efficiency to a large extent, depending upon the design of the propeller. Our front-page illustration this week shows Mr. Hubert Latham's "Antoinette" monoplane undergoing a test of its propeller. The propeller is revolving at the rate of about 1,100 revolutions per minute, which is about the rate of the average electric fan; but when we consider that the propeller describes a circle 6½ feet in diameter, some idea of the volume of air set in motion by the machine can be conceived. At a test made in England last fall, a thrust of 265 pounds was obtained. Supposing the motor to develop only 30 horse-power instead of the 50 at which it is rated, this is equivalent to but 8.8 pounds per horse-power, which is about all the average propeller will give. A prominent American experimenter has lately obtained 325 pounds thrust with a 30-horse-power motor, but in this instance a large 9-foot propeller making but 400 R. P. M. was used. Such a propeller is more efficient and produces a greater thrust per horse-power. In the instance cited it was also of a special form. The illustration shows Mr. Farman at one side of the machine, and Mr. Curtiss at the other. It is curious to note that the hazy circle produced by the rapidly rotating propeller is cut at two points by wide dark bands. These are shadows cast on the blades. The shadows are, of course, intermittent, as they fall upon the blades only as they come within the range of the shadows. This suggests an experiment which was submitted to us some time ago by one of the readers of the SCIENTIFIC AMERICAN. He proposed to show the shadow of a man on a string. The proposition appeared rather startling, but he soon demonstrated that the complete shadow, showing a perfect profile of the man's face, could be shown on the string, provided the string were weighted at one end and whirled around so that it formed a hazy patch of reflected light similar to that produced by the propeller blades in our front-page illustration. The persistence of vision of course accounts for the haze in the first place and for the shadow as well, because both are intermittent, as an instantaneous photograph would show.

The Public Bath System of New York City.

In a paper presented before Section 1 of the American Association for the Advancement of Science, at the Boston meeting, December 28th, 1909, entitled "The Public Bath System of New York City," by William H. Hale, Ph.D., Superintendent of Public Baths of Brooklyn borough of New York city, some interesting facts were stated showing the increase and utility of this recent public institution for the promotion of the public health.

Prior to the consolidation of the surrounding cities into Greater New York there was no interior public bath. All were located along the river front as floating baths. The first interior public bath in Manhattan borough was established on Rivington Street on the east side of the city March 23rd, 1901, and has been the most crowded of any bath, on the average, for the year.

Newer baths opened on Pitkin and Montrose Avenues, Brooklyn borough, have had more bathers in hot weather than any others. It is stated that on one hot summer day 9,000 bathers used them. A third public bath was opened in Manhattan on November 23rd, 1904, in West 41st Street. At the present time there are seven in Brooklyn, twelve in Manhattan, and one each in the boroughs of Queens and Bronx. In the Brooklyn borough during 1908, 2,026,825 persons patronized their fine interior public baths. In 1909, up to December 1st, 2,273,725 persons used all the baths in this borough, showing an increase over the previous year.

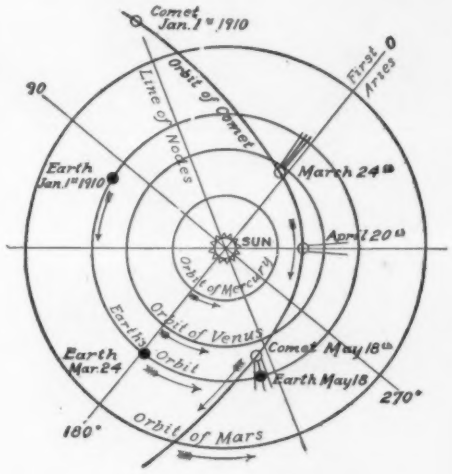
In Brooklyn a small charge is made, 1 cent for a cake of soap and 1 cent for a towel, and an additional charge of 3 cents for the use of a tub bath. The free baths are mostly of the shower kind, although in some later bath houses swimming pools have been built sixty feet long by thirty-nine feet wide, said to be the largest in the city. Newer bath houses have a gymnasium built in the second story above the bath house proper. This has been found to be a most useful adjunct. Mr. Hale suggested still further that roof gardens be built above the gymnasium. He also recommended that there should be a greater extension of facilities for public bathing, particularly the establishment of a great public bath by the sea modeled after the baths at Revere Beach and Manhasset Beach in Massachusetts. At Coney Island on city property such public bath structures could be constructed as would be remunerative to the city and yet would supply a pressing public want. Mr. Hale further recommends the establishment of a separate bureau of public baths and gymnasiums, with uniform pay to attendants and officers, to cover the whole city. The city should have full control of the proposed seaside baths, as they are intended for the entire city and not wholly for the borough in which they are located.

RELATIVE POSITIONS OF HALLEY'S COMET, THE EARTH, AND THE SUN.

BY JOHN C. DEAN.

At the top of the accompanying drawing the comet is shown in its position for January 1st, 1910, outside of the orbit of Mars. At the left the earth is moving in its orbit away from the comet, the distance between them being about 115 million miles.

On March 24th the earth will reach the position shown in the drawing, while the comet will have moved to a point on the opposite side of the sun. During this period (January 1st to March 24th) the comet will be visible, with the telescope, in the western evening sky, but on March 24th, when passing back



RELATIVE POSITIONS OF HALLEY'S COMET, THE EARTH, AND THE SUN.

of the sun, will be invisible for several days. The distance between the earth and comet at this time will be 165,000,000 miles.

When the comet next emerges from the rays of the sun it will have shifted to the morning sky, rising before dawn, and for the first time becoming an interesting object to the naked-eye observer. The earth and comet will now rapidly approach each other and the latter will greatly increase in brilliancy.

About April 20th it will pass its nearest point to the sun, as shown in the drawing, and on May 18th will again disappear in the sun's rays—this time, however, passing in the front of the great luminary. It is predicted that the nucleus will cross the sun's disk about five minutes of a degree from its center, thus furnishing an opportunity to observe whether the nucleus is opaque to the sun's rays.

The transit will not be visible in the United States as it will occur after sunset here.

On the night of May 18th the earth and comet will rush past each other and the earth will probably sweep through the tail of the comet. They will be only 12,000,000 miles apart. After May 18th the comet will attain its maximum of splendor in the evening sky, and in a few days thereafter its glory will rapidly fade.

The Current Supplement.

Dr. Alfred Gradenwitz opens the current SUPPLEMENT, No. 1775, with an article on a snow plow employed on a Swiss railway. Some interesting information on submarine sound signals is presented. Mr. Warren O. Rogers writes exhaustively on friction drums and brakes. The employment of electrolysis in chemical manufactures is made the subject of an instructive article by Prof. B. Lepsius. Mr. Charles R. King describes a new gas fusion process. One of the most important questions in connection with aerial navigation is the provision of suitable places of refuge for the enormous dirigible balloons of which Germany is the proud possessor. The problem is discussed in a copiously illustrated article by our German aeronautic correspondent. Dr. Robert Amory writes on coffee as a beverage and describes a new method of preparing it for the table. The great guano deposits of Peru are described and illustrated. Dr. L. H. Baekeland summarizes the electrical and electrochemical applications of bakelite.

Correspondence.

THE END OF THE "DANIEL TENNEY."

To the Editor of the SCIENTIFIC AMERICAN:

In looking over some old files of the SCIENTIFIC AMERICAN to-day, I found in the issue of March 13th, 1897, reference of the building of the old merchant ship "Daniel I. Tenney," built at Newburyport, Mass., by John J. Courier, Jr.

This item, in connection with the storm now raging, carries me back to eleven years ago to-day, when the "Daniel I. Tenney" was lost off the coast of Scituate, in the disastrous November gale. The wreckage was strewn for miles along the shores of Scituate and Marshfield. A portion of the stern containing the name was thrown ashore opposite the writer's house. I picked up some of the interior finish of the cabin, and have made several pieces of furniture of it, which are prized quite highly by the owners. This is the sad ending of the career of that noble ship which so proudly braved the storms of old ocean so many years.

Perhaps some of your readers may be interested to know where the "Daniel I. Tenney" laid her bones to rest.

W. W. RANDALL.

Sea View, Mass.

THE INVENTOR OF THE STEAMBOAT.

To the Editor of the SCIENTIFIC AMERICAN:

I beg to thank you for publishing my letter, as also for your courtesy in sending me the copies of your current issue.

I wish to point out that although I insist that it would be a most difficult matter to prove that any other of the so-called inventors have any just claim to priority, yet if any reliable proof of any "inventor" having produced a practically successful steamboat prior to 1736 is available, then I would once for all sink any claim on behalf of Jonathan Hulls; but in my humble opinion, from research I have made upon the subject, such is not possible. Therefore I boldly assert that he and he alone should have the great honors ascribed to him. Will anyone refute this?

I claim practical success of his invention, but not commercial success; and to do justice to an inventor's memory, it should not be for the purpose of requiring commercial success. He laid the foundation for commercial success—this fact is undeniable; therefore why should he not have the honors and distinction for his genius? Always remembering that he was many years ahead of his competitors.

I do not admit, what is so generally claimed, that it is not the man who invents, as the man who puts into actual practice, that is deserving of the honors. Without the man who invents, there could not be any need. Neither would he have any place for putting into practice that which he would otherwise have had no knowledge of, had it not been for the earlier inventors.

It appears clear that Jonathan Hulls, although the side-paddle boat had existed for many years propelled by both manual and animal labor, yet he was absolutely the first to suggest steam power to supersede both methods by steam propulsion. And with his original innovation of the stern wheeler, combined with the side paddles, his claim to originality is made doubly sure; always remembering the very early date of his invention and the very crude form of steam engine which then existed. Therefore the greater the honor that should be accorded to him.

With regard to Fulton, no serious claim can stand in face of the foregoing. To put it mildly, he was only a copyist in the matter of steam propulsion. I cannot too forcibly assert that Robert Fulton has no claim whatever, and this fact N. S. Arthur Daniel corroborates. This gentleman asserts that "England should certainly set up a monument for Jonathan Hulls, as he was undoubtedly the original inventor in England"; and he further states, "whether he actually built the boat or not is of no special consequence."

I have been able to provide proof that he did build his boat, and that it was a practical success. Consequently, any additional proofs I have supporting him—and they are numerous—would be quite superfluous.

There could not possibly be more than one inventor of steam navigation, whatever adjectives be used.

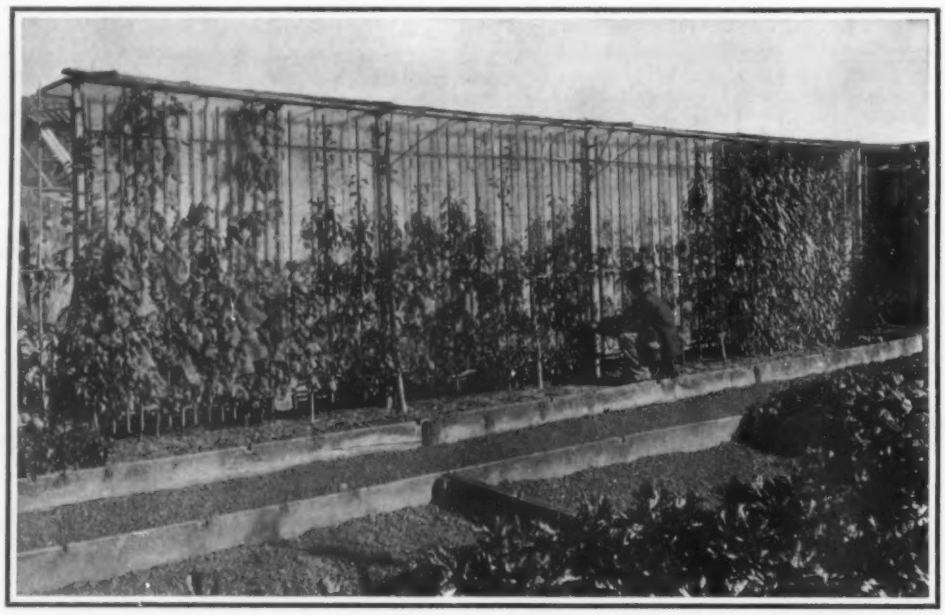
J. HOOPER HULLS.

Manor Park, Essex, England.

GLASS ESPALIER WALLS.

BY JACQUES BOYER.

In the cultivation of fruits on the espalier system, the trees and vines are planted along a wall of stone or brick, to which all their branches are carefully attached, so as to spread them out into a plane surface, and allow free access of light and air to every part. Ordinarily, the direction of the wall is determined by local circumstances, and the varieties of pears, cherries, peaches, apricots, apples, and other fruits which are planted along the wall, are selected with reference to this direction. Until very recently, if the wall was built in an east and west direction, so as to expose one face to the south, the other face was almost entirely wasted. In order to remedy this state of affairs, several fruit growers have conceived the idea of employing transparent espalier walls, through which the light of the sun can penetrate to the trees planted on the north side of the wall. Comte Horace de Choiseul, in particular, has conducted a series of very interesting experiments of this sort on his estate at Viry-Chatillon, in the Department of Seine-et-Oise, and has obtained some very promising results. He built a glass wall 6½ feet high and about 60 feet long, extending in an east and west direction, and planted fifteen pear trees of the variety "Winter Doyen" on each side, north and south. The bearing surface of the wall amounted to about 26 square yards on each side. The south side yielded 134 pears of a total weight of 91 pounds, and the north side bore 119 pears weighing 77 pounds, making in all 243 pears with an aggregate weight of 168 pounds. All of the pears were of particularly fine appearance, without blemishes of any kind, and it is a remarkable fact that the fruit which was gathered from the north face of the wall was even smoother of skin than that which was produced on the southern side. Each square yard of the glass wall produced nine or ten pears of an average weight of about 11 ounces.



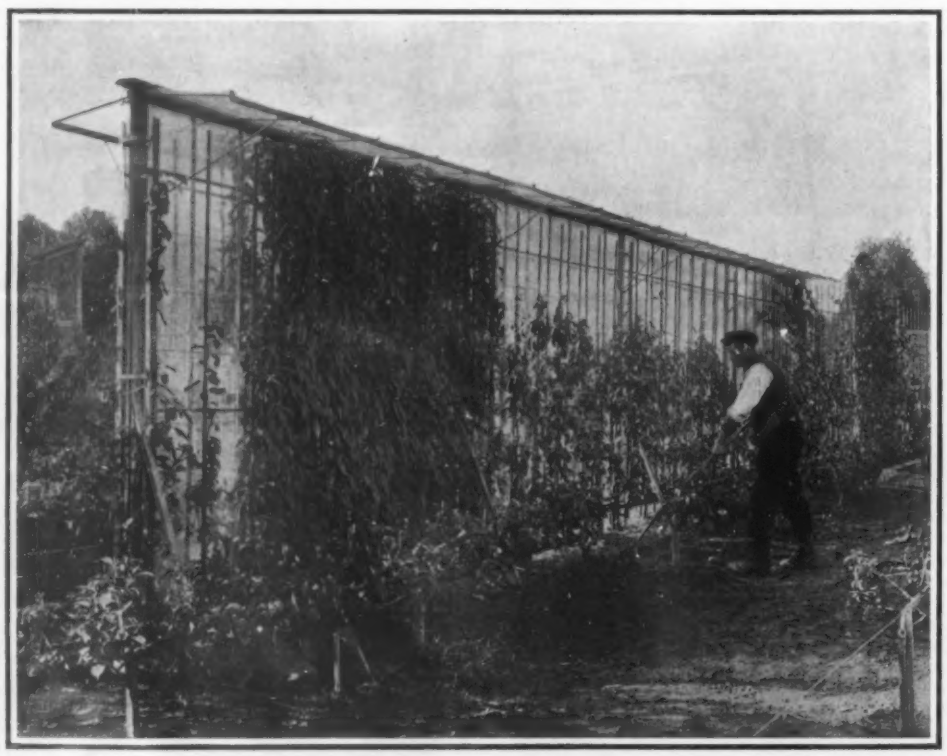
A GLASS ESPALIER WALL (SOUTH SIDE).

Another experiment with glass espalier walls has been made by MM. Croux & Sons in their nursery at Val d'Aulnay in the Department of the Seine. The wall which they constructed also lies east and west, and consequently presents northern and southern exposures. As the accompanying photographs show, the wall is surmounted by a glazed roof projecting on each side. Along each face of the wall were planted Calville apples, Winter Doyen, Passe-Crassane, and Directrer Alphand pears, together with peach trees and grape vines, care being taken to place the same varieties on each side, in order to make the comparison easy and accurate.

In 1907 these trees and vines produced their first crop, in which no difference between the fruit produced from the north and south sides of the wall could be detected. The same result was shown by the crops of 1908 and 1909.

There is, indeed, little difference in temperature between the north and south faces, as the former is heated by the solar rays which traverse the glass, and the latter is cooler than the south side of a masonry wall, for the very reason that some of the incident solar radiation is transmitted through the glass and consequently less is reflected and absorbed. This difference in absorbing power, however, makes the glass wall inferior to the masonry wall in the matter of warming the plants and protecting them from frost at night. A masonry wall absorbs a great deal of heat during the day and gives it out at night, but this effect is comparatively small in the case of a wall of glass.

In the matter of cost, there is little difference between the glass and the masonry walls. The cathedral glass employed by MM. Croux costs about $6 or $7 per linear yard of wall 8 feet high, including the cost of the glazed roof projecting over both sides. A masonry wall of the same height would cost $4 or $5 a yard, and the addition of the glazed roof, which of course is equally necessary in this case, would raise the total cost to $6 or $7 per linear yard. More extensive and long-continued experiments must be made, however, before it will be possible to pronounce a positive opinion concerning the relative merits of glass and masonry espalier walls.



A GLASS ESPALIER WALL (NORTH SIDE).

There is now a prospect of a thorough, explicit census of the population of China. To grasp what this signifies one must first remember that China is vastly the most populous state of the whole world, and secondly, that hitherto such estimates of the number of its inhabitants as have been published have fluctuated between 100,000,000 and 200,000,000 only. Commonly, at the present day, the number of natives in China is mentioned as 400 to 450 millions, but expert geographers brand this number as greatly inflated. In many late books, in consequence, the reader finds only 300 to 350, or indeed only 250 millions stated as the probable extent of the population. Naturally it occurs to the thinker that the importance of all suppositions in regard to a "yellow peril" and its directions must depend very largely on a sure calculation of the size of the population of China.

Of course, in the course of former centuries the Chinese government projected and made at least the semblance of various censuses, so that when they were published they were found to be mostly mere statements of the approximate number of families and were therefore quite unreliable. And the shadowy value of such censuses was not improved, by the way, by the chicanery of the governments of the individual provinces, who, when a census was ordered for the purpose of military conscription or of collection or application of a tax, promptly falsified the figures.

Now, finally, the gigantic project of a real census of the whole Chinese Empire is to be executed, and in the double form of a census of families and a census of individuals. The former is to be ready by the early part of 1910, the latter by 1912. In view of the immense extent of the Chinese Empire the vastness of this task can hardly be overestimated. The stupendous endeavor required by such a work can be sustained, however, by the present excellent organization of the Empire, though the fact cannot be ignored that certain parts of the Empire deem themselves wholly independent and will therefore resist the necessary official visitation required by the census in such districts or will try, through the stiffest mendacity possible, to make the results of the census, as far as they concern themselves, utterly ridiculous.

Despite the recognition of the inevitable effect of such uncertainties and defects, however, the definite attempt to make a careful census of the population of China would be of great value, and even if the final published result of the double form of the census were not correct by 20 to 30 million individuals.

Concrete poles hexagonal in shape and hollow through the center are used by the Oklahoma Gas and Electric Company. A 35-foot pole measures 7 inches across corners at the top and 16 inches across at the butt. They are molded in forms made up of 5-foot sections, so that it is possible to cast a pole of practically any length. Steel rods are placed symmetrically about the central axis and at the top and bottom project through holes in a steel plate. The rods are bent over at each end and securely fastened. The core, which is wrapped with one thickness of building paper, is suspended within the form by wires at intervals along its length. The concrete used consists of a mixture of 1 part cement, 2 sand, and 3 parts chats or zinc tailings, which can be obtained from the zinc mines of Missouri.

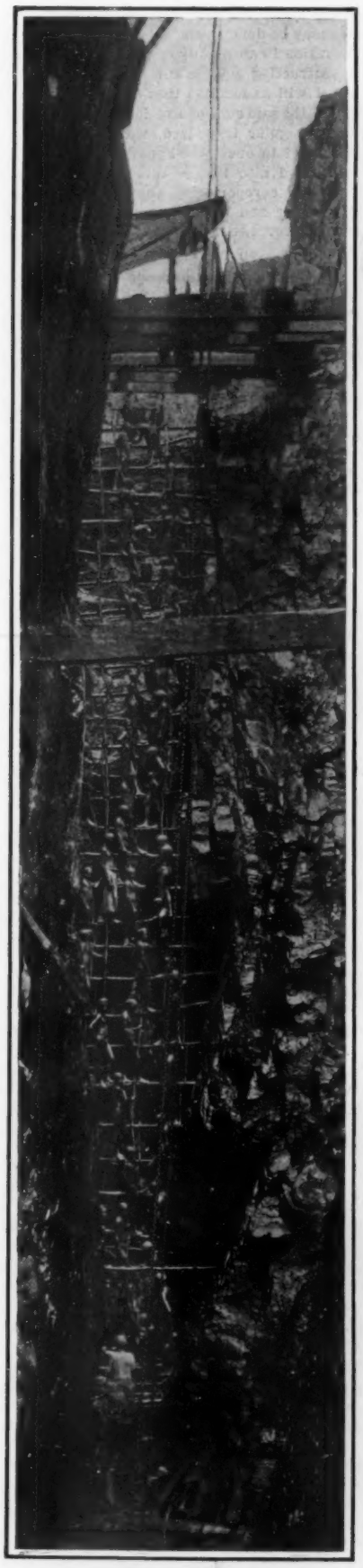
GRAPHITE MINING IN CEYLON.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Among the various minerals found in the island of Ceylon, that which is the most abundant is graphite, or plumbago, practically the only one found in sufficient quantity to render exploitation profitable. It has attained a worldwide reputation for its excellent quality, its composition being practically pure carbon, and is in extensive demand for crucibles. The average output is approximately 50,000 tons per annum, the greater part of which is exported to Great Britain and the United States. Within the past two decades the trade has undergone considerable expansion, with the result that mining is being extensively developed.

The mineral is found in veins and nests in the crystalline rocks, occurring frequently in a fibrous or flaky form, the flakes being disposed at right angles to the wall of the vein. These veins vary in width, sometimes being less than an eighth of an inch, while in others they will extend to several feet. Some are found to follow the foliation planes of the various rocks, while others run crosswise or branch in all directions. As a rule, in a series of shafts sunk close to one another, it will be found that a single main vein or several parallel veins will extend through the whole of these pits with minor vanes stretching from either side along the planes of division. Even if the mineral is not found in continuous veins, but rather in isolated pockets or nests, these are generally parallel to one of the main directions. Investigations show that the mineral exists in a series of belts, but their extension can-

(*Continued on page 36.*)

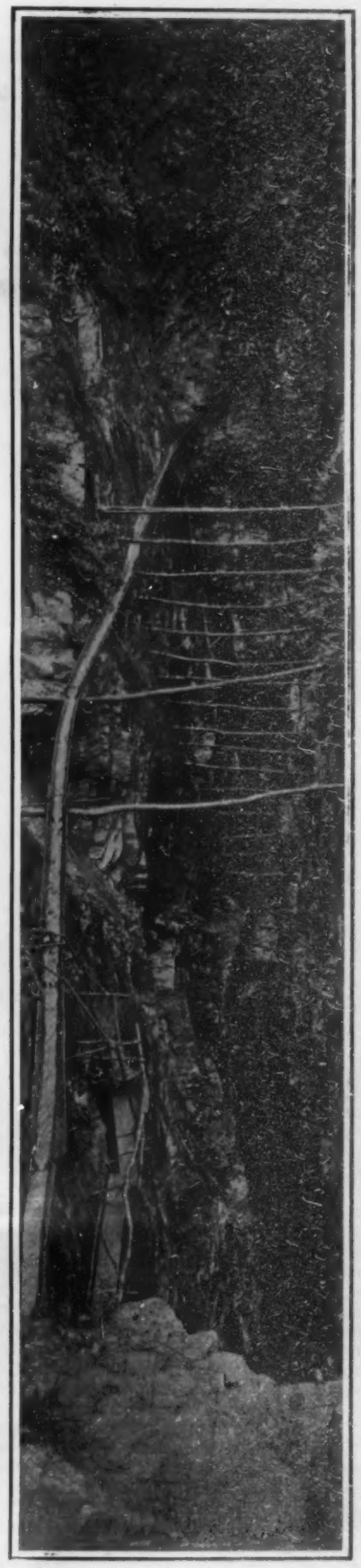


Bamboo ladderway in graphite pit. A continuous stream of miners carrying baskets of plumbago.

Sifting and screening the graphite.

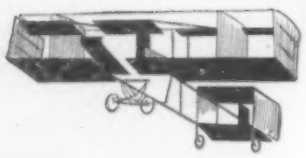
Hand cleaning, sifting, and breaking large pieces of graphite after screening.

Final grading of graphite into first and second qualities and package for shipment.

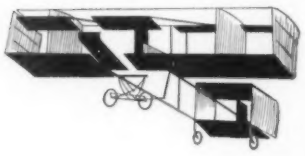


Graphite pit, showing crude baling arrangements. Baling is carried on by natives.

GRAPHITE MINING IN CEYLON.



RUFUS PORTER AND HIS "FLYING SHIP."



BY C. E. McCLUER.

Soon after the Montgolfiers invented their first "hot-air" balloon, which was almost immediately followed by the first "gas" balloon, the attention of scientists and inventors seems to have been centered on the spherical and elongated gas bag as a means of flotation, and the provision of propellers and rudders to enable the navigator to control the movements of the unwieldy and wind-tossed sphere, and produce what is now known and briefly described as a "dirigible" balloon. Omitting all reference to the work of the many accomplished and venturesome balloonists who originated or copied the various devices which they adopted for the guidance and management of their spherical or pear-shaped, or elongated and cigar-shaped gas envelopes, we will revert at once to the subject of our sketch.

Rufus Porter, belonging to that numerous class of ingenious New Englanders usually styled "Yankee inventors," was born at West Boxford, Mass., May 1st, 1792, and died in New Haven, Conn., August 13th, 1884. Although he received only a common district school education, he possessed an alert mind and a retentive memory, which, coupled with a natural genius for observation and invention, fitted him admirably for an active and useful life. He early displayed inventive abilities of no mean order, as is attested by the list of his patented inventions disclosed by the records of the Patent Office. Some of his patents displayed an acumen and foresight which led him into the van of progress, and proved that he was fully abreast if not actually ahead of his time. Among his numerous patented inventions we find enumerated a cord-making machine, a steam carriage or ordinary road vehicle, prophetic of the latter day automobile, a pioneer treadmill horse-power machine, a corn sheller, the inevitable Yankee churn, a washing machine, a signal telegraph, and a municipal fire-alarm system, the latter doubtless being the forerunner of the largely adopted and efficient Gamewell fire-alarm system, now so largely in vogue.

In 1840 we find Porter as editor of The New York Mechanic, the first purely scientific newspaper published in the United States. The next year it was removed to Boston, and the title changed to The American Mechanic. In, 1845, evidently not having made a pronounced success with the publication of The American Mechanic, he returned to New York and began the publication of another journal, which he styled "Scientific American, the Advocate of Industry and Enterprise, and Journal of Mechanical and Other Improvements," on a cash capital of $100. The first number of the new periodical was issued on the 28th day of August, 1845. After six months of struggle, with varying success, his journalistic enterprise was purchased by the present proprietors of the SCIENTIFIC AMERICAN.

Among Porter's less noticed inventions, and the one from which I presume he reaped the smallest recompense, was a flying machine, or as now styled, a "dirigible" balloon, but which he dubbed an "aeroport." As nearly as I can ascertain from the records at my command, this invention was made and patented in 1820, but not until 1852 did Porter seem to make any serious effort to exploit the device. In that year he organized what he called "The Aerial Navigation Company," and attempted to raise the funds necessary to enable him to construct his first aeroport by an appeal to popular support through the sale of $5 bonds or certificates.

Among the papers of my deceased father I have recently found one of these bonds, issued to him under date of April 29th, 1852, a facsimile of which is reprinted herewith.

Below follows an abbreviated copy of the "proposition and prospectus" alluded to in the bond, as I find it printed in the issue of the National Intelligencer of March 19th, 1852.

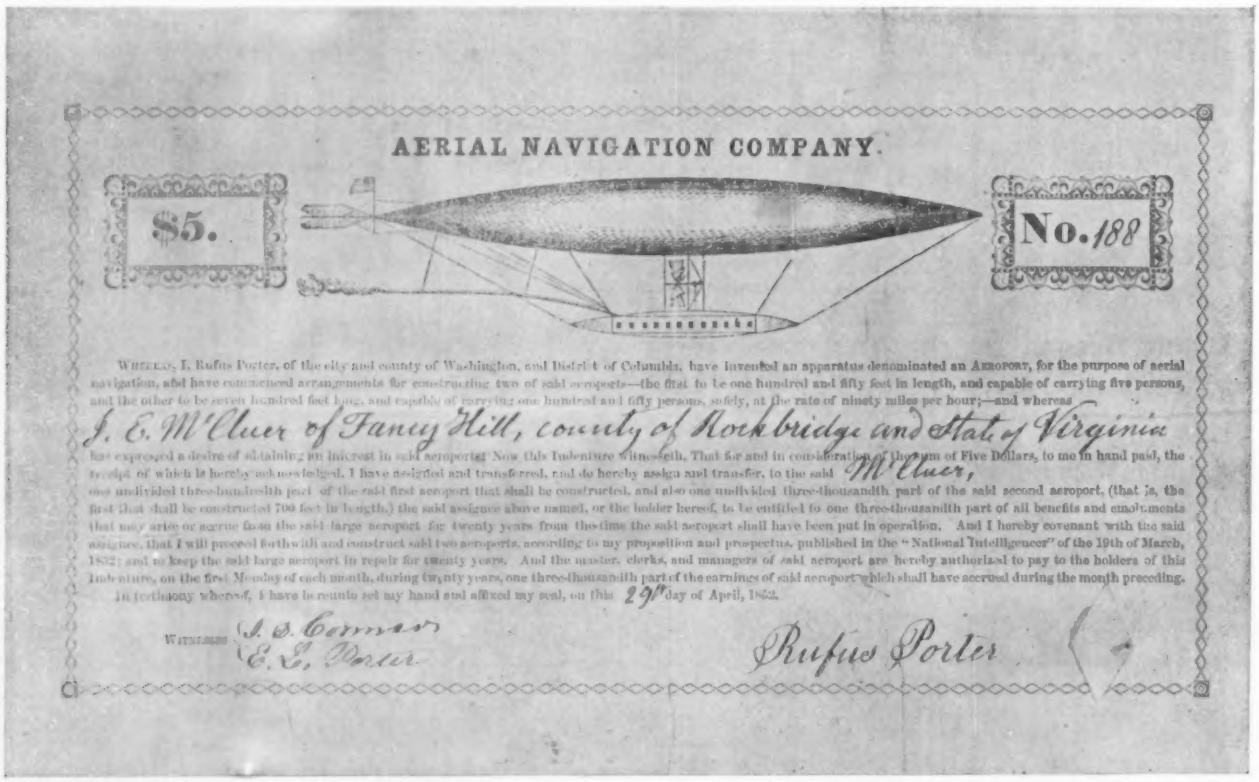
"THE FLYING SHIP."

"A chance to secure a cash income of $10 to $20 per week for twenty years by the investment of five dollars in advance.

"It is extensively known that the undersigned has by theory and practical experiments so fully demonstrated the practicability of aerial navigation that all who have fully examined the subject are convinced; and no person, even of those whose interests are adverse to its success, can offer a word of rational argument against it. Several model machines have been constructed, and each of them has operated successfully; and one of them, sixteen feet long, carried a small steam engine, by the power of which the machine was propelled; and, being guided by its own helm, travelled rapidly through the air, even against a breeze of wind, in direct lines or circles, according to the adjustment of its helm. This machine was witnessed and applauded by hundreds in New York and Boston, and notices thereof were published in several newspapers of those cities at the time. Since those experiments were made the inventor has made additional improvements whereby the invention is now perfected. And it appears certain that a safe and durable aerial ship (or aeroport), capable of carrying one hundred and fifty passengers at a speed of ninety miles an hour, with more perfect safety than either steamboat or railroad cars, may be constructed for $15,000, and that the expense of running it will not exceed $25 per day. It is ascertained by a minute and careful estimate that an aeroport 150 feet long and capable of carrying five persons at a speed of sixty miles per hour, may be constructed for $1,500. Now, having been disappointed of the funds requisite to put this invention in operation on a scale of practical utility, I propose that if three hundred persons will subscribe five dollars each, payable when the whole amount of 1,500 dollars shall have been subscribed, I will forthwith construct this pioneer aeroport, (which may be done in six weeks); and when this is put in operation I can readily command the requisite funds for constructing a large aeroport as above mentioned. And I will so arrange that each subscriber on the payment of the said sum of five dollars, shall be furnished with a regular title deed, which shall entitle the holder thereof to one three-hundredth part of this first aeroport, and also to one three-thousandth part of the first large aeroport that shall be constructed, and of all benefits and emoluments that may be derived therefrom for twenty years; the said aeroport shall be kept in repair without expense to the shareholders. . . . Washington, March 16th, 1852. Rufus Porter."

While with the added knowledge and experience of a half century we can see wherein Porter was mistaken in his calculations and visionary to a considerable degree, we can also see wherein he was in advance of his day and generation, and prepared to achieve the success that later and quite recently attended the efforts of Count Zeppelin and others of the present day, had he but been in possession of the gasoline or alcohol motor as now applied to dirigible balloons and aeroplanes. Comparing the fanciful representation of his aeroport as given by the engraving printed on the bond, one cannot help being struck with its resemblance to the modern dirigible balloon. While, without repeating Porter's calculations as to the capacity of his aeroport for tonnage and speed, I judge he was guilty of exaggeration, he certainly came mighty near the ideal conditions for a successful dirigible balloon with weight of engine, boiler, and cabin greatly reduced. What method he adopted for stiffening his gas cylinder in the absence of the metal aluminium, as used by Count Zeppelin, is not disclosed, but it is quite possible an inspection of his patent might disclose some adequate provision for that purpose.

Rufus Porter is certainly entitled to all the credit attaching to the organization of his "airship" enterprise, and the exercise of his superior inventive faculties in connection with the science of aeronautics and as a pioneer in that department of human endeavor.



AERIAL NAVIGATION COMPANY.

$5. No. 188

WHEREAS, I, Rufus Porter, of the city and county of Washington, and District of Columbia, have invented an apparatus denominated an AEROPORT, for the purpose of aerial navigation, and have commenced arrangements for constructing two of said aeroports—the first to be one hundred and fifty feet in length, and capable of carrying five persons, and the other to be seven hundred feet long, and capable of carrying one hundred and fifty persons, safely, at the rate of ninety miles per hour;—and whereas J. E. M'Cluer of Fancy Hill, county of Rockbridge and State of Virginia has expressed a desire of obtaining an interest in said aeroports: Now this Indenture witnesseth, That for and in consideration of the sum of Five Dollars, to me in hand paid, the receipt of which is hereby acknowledged, I have assigned and transferred, and do hereby assign and transfer, to the said M'Cluer, one undivided three-hundredth part of the said first aeroport that shall be constructed, and also one undivided three-thousandth part of the said second aeroport, (that is, the first that shall be constructed 700 feet in length,) the said assignee above named, or the holder hereof, to be entitled to one three-thousandth part of all benefits and emoluments that may arise or accrue from the said large aeroport for twenty years from the time the said aeroport shall have been put in operation. And I hereby covenant with the said assignee, that I will proceed forthwith and construct said two aeroports, according to my proposition and prospectus, published in the "National Intelligencer" of the 19th of March, 1852; and to keep the said large aeroport in repair for twenty years. And the master, clerks, and managers of said aeroport are hereby authorized to pay to the holders of this Indenture, on the first Monday of each month, during twenty years, one three-thousandth part of the earnings of said aeroport which shall have accrued during the month preceding.

In testimony whereof, I have hereunto set my hand and affixed my seal, on this 29th day of April, 1852.

WITNESSES: S. S. Conner, E. E. Porter. Rufus Porter (L. S.)

FACSIMILE OF THE AERIAL NAVIGATION COMPANY BOND WHICH SHOWS THE PORTER AEROPORT DIRIGIBLE CAR.

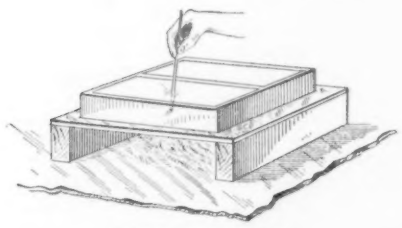
Handy Man's Laboratory

IMITATION MARBLE.

BY A. J. JARMAN.

A simple method of imitating marble with all its beautiful vein markings, spots, and irregular lines and variable colors, is as follows:

The skill in giving the veining, etc., to the product will be quickly attained by making a few small slabs in a plain way previous to undertaking the production of a larger number. The colors for the veining must all be of a mineral character, as follows: plumbago (black lead), chrome green (dark), common crocus,



IMITATION MARBLE.

yellow ocher, red oxide of iron, and ultramarine blue. Procure a few pieces of stout sheet glass, say 7 inches by 11 inches (an ordinary 11 x 14 photographic negative cleaned and cut in halves is just the thing). Make a wooden frame of ½-inch board, an inch deep with a division in the middle, simply held together with 1-inch iron brads not driven firmly in. Leave an eighth of an inch projecting so that they can be easily withdrawn with a pair of pliers. Arrange these strips of wood, after being smoothly planed all over, so as to give two squares of five inches internal measurement.

Make up the following in a bottle: Paraffin wax, ½ ounce; benzine, ½ pint. Place this, well corked, in a warm room to dissolve; aid this by shaking it occasionally. When the paraffin is dissolved it is ready for use. Brush some of this preparation all over the inside of the wooden panel. Then take a piece of Canton flannel or soft rag, wet it with the benzine mixture, rub this well all over the smooth side of the glass plate, polish it thoroughly with two pieces of soft rag until there appears to be nothing left, and place the frame upon the glass plate. Now lay a mirror, or a piece of plain silvered glass upon the work bench, or table, and place a block of wood at each end so that the glass plate and frame will rest about four inches above the mirror, the frame being held in place by a couple of rubber bands. Place a teaspoonful of chrome green in a small saucer and a teaspoonful of black lead in another saucer and add a dessertspoonful of water to each.

Mix the following in any suitable vessel (a small stoneware pitcher being well suited): To ten ounces of water add sufficient plaster of Paris to make a mixture of the consistency of thick cream. Skim off the air bubbles and any dust that may float on top, when in the course of a minute or two the plaster must be poured carefully into one side of the square on top of the glass plate. Fill this nearly half way. Pour the remaining portion into the other square. Now dip a small brush into the moistened black lead, press it through the soft plaster and paint the plain or zig-zag veining or spots. The plaster blends beautifully with the color and the mirror enables one to see the effects produced. Any line made too strong or lumpy in appearance can easily be rectified by a light stroke of the brush. Green streaks or veins may be painted with the same brush after washing it quickly and dipping it into the chrome green. Treat the other square in the same way.

Having now produced the veining, the block may be reinforced as follows: Have ready to hand a few pieces of galvanized iron netting. Cut a piece 4½ inches square with a quarter of an inch or three-eighths of an inch mesh. Bend up the wire ends and lay the piece down upon the plaster with rough ends sticking up. In the same pitcher that the plaster was mixed make up about the same quantity of Portland cement. Pour in the water first and then add the cement, a small quantity at a time, pour the mixture upon the plaster and wire netting until the panel is filled. Treat the second square in the same way, allow the whole to stand for an hour, until both plaster and cement have become quite set. As soon as all has become well set, draw out the brads with a pair of pliers and remove the woodwork carefully. This will hasten the drying. Take care not to shift the cast blocks upon the glass plate. Let them become quite dry while in contact. When dry the colors will not be more than one-third as brilliant as when wet, the effect being precisely like marble. The face of these blocks will possess very smooth surfaces with only a partial gloss upon them, being at the same time porous. The porosity can be stopped and the gloss much improved by the use of amylacetate collodion. This is practically a solution of gun cotton in amylacetate, which not only fills the pores of the plaster, but forms a coating as clear and transparent as water. It resists the action of weak acids and alkalies and can be washed with water and a chamois leather at any time without injury to the object it covers.

When the squares are perfectly dry and slightly warm they must be placed in a plate or large saucer, containing a mixture of amylacetate collodion and one-third amylacetate. This thin collodion will penetrate the pores of the plaster for a quarter of an inch or more in a short time. Remove the square and stand on one corner to dry in a warm place. When dry a coating of the thick amylacetate collodion may be brushed upon the surface and allowed to drain from the opposite corner. The surface will improve in brightness with every coating. Amylacetate collodion costs about two dollars per gallon at any wholesale chemist's. A gallon will go a long way in waterproofing such slabs of imitation marble as here described.

A much harder material with a slight grain can be produced by mixing a small quantity of ground pumice or ground glass with the plaster, which must be intimately mixed to insure uniformity. This mixture is sometimes termed Parian cement. Imitation marble blocks can be made by the above process into any shape, such as a keystone for a mantelpiece or circular with an inlaid border, and in many other ways that will suit the taste of the individual worker. In place of Portland cement, Parian cement may be used as described above, thus producing a slab of an almost uniform color. Any size of slab may be made as described. Of course the thickness must increase with the size of the slab to give strength.

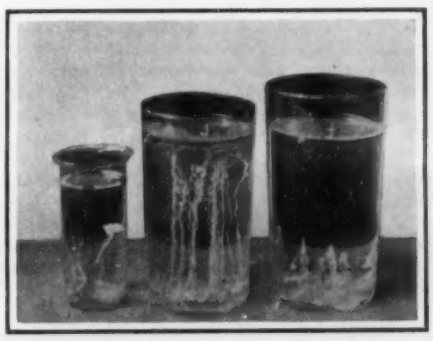
SOME CURIOUS CHEMICAL GROWTHS.

BY ALFRED P. MORGAN.

The following experiments are somewhat out of the ordinary, but may be performed with the materials at hand in any chemical laboratory, or obtainable at a well-stocked drug store.

In the first experiment mercury is prepared by throwing into it small pieces of clean metallic sodium. The sodium will almost immediately take fire and leave a hard crust on the surface of the mercury. Break this crust with a glass rod, and stir it in the mercury until it dissolves. The little pill bottle on the right in the illustration contains five cubic centimeters of mercury having sodium dissolved in it. The tumbler on the left shows five cubic centimeters transformed into "ammonium amalgam," and occupying a space over fifty times the original volume of the mercury. The transformation was brought about by

A SPONGE-LIKE TRANSFORMATION OF MERCURY.



PLANT-LIKE GROWTHS DUE TO OSMOTIC PRESSURE.

throwing the mercury into a tumbler containing a strong solution of sal ammoniac in water. The mercury immediately swells up into a spongy mass. The time elapsing between the moment when the sodium amalgam was thrown into ammonium chloride and the taking of the photograph illustrated here was about thirty seconds.

The reaction may be represented as follows: (Na dissolved in Hg) and NH_4Cl = (NH_4 dissolved in Hg) + NaCl.

Upon examination of the mass, it is seen to be very spongy in nature, and its growth in all probability caused by the evolution of a gas. This is indeed the true explanation of the phenomenon. The NH_4 of the ammonium chloride dissolves in the mercury, but soon the mass decomposes, and bubbles of ammonia and hydrogen gas cause the enlargement.

In a few moments the mass will begin to sink, and a strong smell of ammonia will be noticeable. If a lighted match is held over the small bubbles arising from the liquid, they will burn, lighting with the "pop" indicative of hydrogen. The mercury will soon return to its normal condition, in accordance with the following equation:

$$2\ NH_4 \text{ dissolved in } Hg = 2\ NH_3 + H_2 + Hg.$$

There can be no doubt that the NH_4 is actually present in solution in the mercury, for when a salt of ammonium is decomposed by electrolysis, the NH_4 ion upon its discharge gives ammonia and hydrogen and no NH_4 is formed. But if a pool of mercury is used as the negative electrode, the NH_4 dissolves in the mercury and forms an amalgam with it. However, during the formation it swells up and gives off the products mentioned above.

GROWTH OF ALUMINIUM OXIDE ON A TELEPHONE RECEIVER.

The most interesting point about this experiment is that it is in accordance with the theory that ammonium would have the properties of a metal if it could be isolated, for excepting this substance the metals themselves can only be dissolved in mercury.

The second photograph is an illustration of an experiment depending upon the peculiar property of aluminium amalgam.

The action of sulphuric and nitric acids upon ordinary aluminium is very slow, because the metal receives a coating of aluminium hydroxide and is shielded from the acid; but if the aluminium is amalgamated with mercury, the action is very rapid.

Aluminium has a very great affinity for oxygen, and will displace all the metals save magnesium from their oxides. If a mixture of aluminium powder and ferric oxide is placed in a crucible, and fired by means of a piece of burning magnesium, a violent reaction takes place, enough heat being produced to leave the iron, which is one of the products, in a highly molten state. This is the principle of the "thermite" used for welding, etc.:

$$Fe_2O_3 + 2\ Al = Al_2O_3 + 2\ Fe.$$

Some idea of the speed of reaction and the heat generated may be gained if three small iron crucibles are placed in a vertical column, one above the other and separated five or six inches. A mixture of aluminium and ferric oxide is placed in the top crucible and ignited. Almost immediately molten iron will melt its way through the bottom of the first crucible, and pass through the second and third as if there was nothing in the way. A box of sand should be placed beneath the bottom crucible to catch the molten metal.

The affinity of aluminium for oxygen can be shown by amalgamating a piece of the metal with mercury. The surface is almost immediately oxidized, and the result is a growth of white tufts of aluminium oxide over the surface of the metal where it has been amalgamated. The growth will rise about one-eighth of an inch or more in five minutes.

The easiest method of amalgamating the aluminium is to clean a small portion, and then drop upon it some mercuric nitrate solution and allow it to dry. The growth will immediately commence.

In the illustration, the case of an aluminium-backed telephone receiver has been used for the experiment, and the resulting growth is shown by the white spots, principally on top at the left.

The third photograph is a striking illustration of osmotic pressure. The tall plant-like growths may be formed by throwing small pieces of any of the following crystalline chemicals, ferric nitrate, copper chloride, cobalt nitrate, nickel sulphate, and manganese sulphate into a beaker glass containing a diluted solution of sodium silicate of 1.1 specific gravity. The crystals will almost immediately sprout up into various fantastic shapes, and grow several inches in the course of a few minutes.

The salts dissolve in the water of the sodium sili-

cate solution, and react with the sodium silicate to form a silicate of the metal of the salt added. For instance, in the case of copper chloride, copper silicate is formed:

$$CuCl_2 + Na_2SiO_3 = CuSiO_3 + 2\,NaCl.$$

Silicate of copper is insoluble, and so the result of the reaction is a small portion of liquid around the crystal of $CuCl_2$ surrounded by a sack of insoluble $CuSiO_3$, where the copper chloride has come into contact with the sodium silicate.

Particles of a *dissolved substance* exercise a pressure similar to that of a gas, explained in physics texts under the title of the kinetic-molecular hypothesis.

When the sack is first formed the pressure is equal on both sides, but as more of the copper chloride dissolves, the pressure on the inside of the sack becomes so great that it bursts at the top, where the *hydrostatic* pressure of the liquid is least and the sack weakest.

The liquid spurting out of the top is immediately surrounded by a new sack, and the process continues until the salt is exhausted or the growth reaches the surface of the liquid.

The silicates of the metals of the salts mentioned in the list above are also insoluble, and the same explanation holds true for their action.

WIRELESS EXPERIMENTS WITH A STATIC MACHINE.

BY E. H. WILLIAMSON, JR.

In the large quantity of literature on wireless telegraphy practically the only method described of producing the high-tension currents required is that of using a powerful induction coil or a high-tension transformer on an alternating current. The possibility of utilizing the discharge from a direct generator of static electricity is barely touched upon. In order to test the practicability of the use of such a source of current, the writer constructed a static machine of the Wimshurst pattern and made some experiments with it. The machine, a photograph of which is shown herewith, was fitted with two glass plates twenty inches in diameter, supported on a half inch steel shaft. Each plate had thirty sectors of heavy tinfoil, 3½ inches long. The brass work was made from 3-16th round rod, and the brass balls on the collectors and Leyden jars were purchased from a manufacturer of brass bedsteads, as were the large balls terminating the discharge rods and the sending device below. These balls were filled with crushed tinfoil, and contact made by inserting the supporting rods in wooden bushings fitted in the necks of the balls.

The two Leyden jars showing at the front of the machine were made from hydrometer glasses provided with feet, and each had a combined inner and outer coating of 65 square inches of foil. The interior coatings were arranged to be connected with the discharge rods by short loops of brass chain, and the exteriors joined with a similar chain laid along the base of the machine. The device shown attached to the front support is the key by which the spark is thrown into the aerial and ground, and the messages sent. By pressing the lower lever, the rocking arm above it, which supports the two insulated balls, is pulled upward, and the latter are thrown into range of the spark from the discharge balls. One of the key balls is connected to the aerial, and the other to a good ground such as a gas or water pipe. I found it best to allow the aerial ball to take its charge from the positive discharger. By pressing the key for longer or shorter intervals, the dots and dashes of the code are easily obtainable.

An aerial was erected on my roof at a height of 45 feet above the ground, consisting of two horizontal copper wires supported on two-foot spreaders with leads off near the center, running to the edge of the roof, where they were joined, and a single wire led thence to the machine on the third floor. This aerial gave a wave length of about 72 meters. Owing to the extremely high tension and evanescent nature of the discharge, it was necessary to insulate the wires with great care, which was done by supporting them in paraffined glass tubes. The machine as constructed gave a solid stream of bright two-inch sparks, resembling those from an induction coil, when the large discharge balls were used and the jars unconnected. With the latter in circuit in the usual manner, a very thick, loud, and powerful spark of about the same length was obtained at intervals. With a large ball on the right-hand rod and a small one on the left, a much thinner and more frequent spark from five to six inches long appeared.

The first experiments in sending messages were conducted with the receiver in a room about thirty feet away from the machine, using a gaspipe ground and

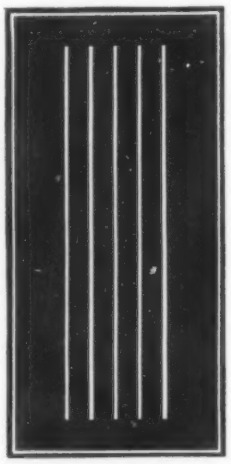


Fig. 1.—GRATING WHICH GIVES THE COLOR ILLUSION.

no receiving aerial. A number of detecters were constructed experimentally, including a coherer and decoherer with a ¼-inch gap filled with nickel-silver filings, a microphone consisting of a piece of hard pencil lead bridging two steel needles, a bare point electrolytic, and a Marconi magnetic detecter. In all the tests made, the coherer gave the best results at short range, and the microphone the best for longer distance; indeed, the sounds were much clearer in this case than when the electrolytic was used, though the latter is considered the most sensitive of all.

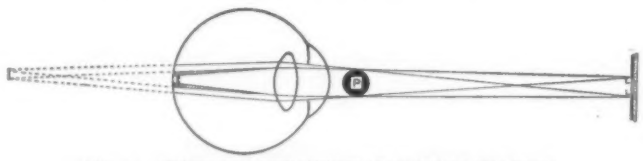


Fig. 2.—DIAGRAM EXPLAINING THE COLOR ILLUSION.

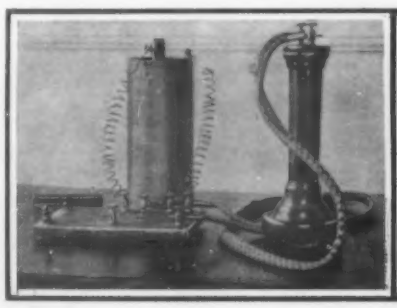
In these experiments a home-made relay of 200 ohms resistance was used with the coherer, and a pair of 75-ohm ear phones with the microphone. In the experiment conducted in the near-by room, the straight spark from the discharge balls was used, and gave clear signals. The coherer was then moved to the back yard and provided with a ten-foot aerial stretched horizontally six feet above the ground, the other connection being to a water pipe. The signals were still received clearly, but on increasing the distance to three hundred yards no result was obtained with either receiver, although the aerial was extended to a length of thirty feet.

In order to increase the power of the spark, the inner coatings of the jars were connected to the dischargers, the outer coatings still remaining unconnected.

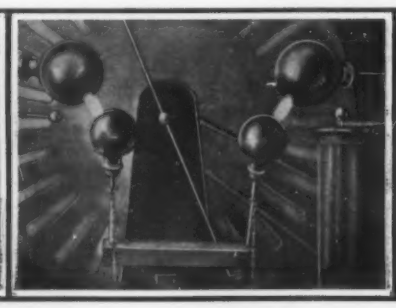
By this arrangement a shorter, thicker, and more brilliant spark was thrown into the key balls, which, while not as frequent as in the former case, was sufficiently continuous to easily permit sending distinct dots and dashes when the machine was driven at a slightly higher speed. The microphone now responded clearly when the key was worked, showing the increase in efficiency of the new arrangement, and a more ambitious experiment was decided upon. The receiving station, including microphone, telephone receiver, tuning coil, batteries, etc., was transferred to a house three-quarters of a mile away, and a receiving aerial erected. As the owner of the house objected to the use of the roof for this purpose, I was compelled to put up a rather inefficient aerial of a vertical type, projecting from a third-story rear window.

Three clothes props were spliced together for a support, and a three-foot spreader fixed at the top, from which were suspended a pair of copper wires thirty feet long. These wires were joined at the bottom and led to the tuning coil, which had a capacity of 125 meters, and thence to the microphone. At a prearranged hour, my better half patiently worked the static machine at the sending end for fifteen minutes, sending dashes at slow speed and in groups of three, to avoid confusion, and these signals could be faintly but unmistakably heard in the phones at my end.

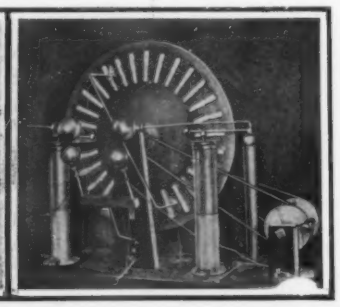
I have no doubt that with a more efficient aerial, variable condenser, high-resistance head phones, and potentiometer for the battery, the receiving distance could be enormously increased. Possibly a zinc spark gap and sending helix would be an advantage at the sending end. A multiple machine, having three or more pairs of plates, would probably have sufficient capacity to rapidly charge and discharge a small pair of Leyden jars, and so send greatly increased power into the aerial and increase the radius of efficiency. The details of the spark gap, showing the character of the spark, as given from the interiors of the jars alone, as used in the foregoing experiments, are shown in one of the photographs. The receiving apparatus with the exception of the tuning coil is also shown herewith.



RECEIVING APPARATUS, SHOWING THE MICROPHONE DETECTER.



PHOTOGRAPH SHOWING CHARACTER OF SPARK DISCHARGE.



THE WIMSHURST MACHINE AND THE TRANSMITTING KEY.

A COLOR AND RELIEF ILLUSION.

BY PROF. GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

Hold a pin vertically with its pointed end between the thumb and forefinger. Place the pin thus held before your eye, in contact with your eyelid. Close the other eye and look at the drawing, Fig. 1, this being at a distance of about three to five inches from your eye.

Two differently colored gratings, apparently placed at two different distances from the eye, both of them made up of vertical lines, will immediately appear. One seems to be relatively near. Its lines have a dark brownish hue. The other is made up of dark bluish bars and every one of these seems to stand at a distance behind the first grating. If the figure be moved laterally, the near-by, brownish lines are seen to move on with the paper but the bluish bars run in the opposite direction.

The near-by, brownish bars are the black stripes of the figure. In spite of the fact that the distance between the figure and the eye is shorter than that of distinct vision the stripes are not much blurred, as the pin decreases the aperture of the pupil and thereby increases the depth of focus.

The far-away, bluish bars are the shadows cast by the pin on the retina in the middle of every luminous beam sent by the corresponding white line. The shade is cast right side up, but the retina inverts it, and the result is the curious inverse motion of the bluish bars when the paper or pin is made to travel laterally.

The origin of the bluish color of these bars is shown on Fig. 2. *L L* is the cross section of a white line. The pin *P* (relative size is exaggerated) closes the central part of the crystalline lens, and as the achromatism of the periphery is imperfect, there is a rather strong dispersion of the white light. The blue rays *B B* of the shaded spectrum invade the obscure central zone, which is the shadow of the pin. This assumes a bluish hue. For a similar reason, the less refrangible colors, red and yellow, lag behind and remain on the image of the black stripes, right and left of the white line. The admixture of colored light to the dark stripes is increased by the fact that the whole image being out of focus the limit between the black and white lines cannot be sharp.

The blue rays meet to a focus before the red and yellow rays; they give therefore the impression of coming from a far-away luminous object. The contrary statement is true for the red and yellow rays. This accounts in part for the fact that the brownish bars seem to be nearer than the bluish lines. The writer confesses, however, that this explanation does not entirely satisfy him.

Indestructible black ink is made from 1 part lampblack, 12 potash waterglass of syrupy consistency, 1 part fluid ammonia, and 38 parts of distilled water.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

SANITARY TELEPHONE-TRANSMITTER.—M. Y. CALCUTT, Seattle, Wash. The mouthpiece in common use is a most prolific source of disease caused by the accumulation of germs therein. This is especially the case with public telephones. The invention provides a device which will take the place of the ordinary mouth-piece and it is covered when not in use, thereby preventing the accumulation of dust or germs. The transmitting members may be cleaned automatically and disinfected each time after use.

Of Interest to Farmers.

COMBINED DISK AND SHOE SEEDING DEVICE.—N. L. HECKMAN, Marion, Ind. In the present patent the invention has reference to improvements in combined disk and shoe seeding devices, and has for its object to produce a device in which the lower seed conduit or shoe forms a part of the furrow opener and deposits the seed at the periphery of the disk.

WEED-ERADICATING MACHINE.—B. F. SCOTT and J. A. SCOTT, Jasper, Minn. This machine extracts weeds, roots, rubbish, etc., from the ground, and delivers the above materials into a receptacle by means of a structure which carts it from the field. The structure is resilient, thereby avoiding breakage of the machine parts, and the machine is simple and inexpensive in structure.

COW-STALL.—C. S. TORREY, Bellevue, Mich. The invention affords a triangular rear wall for a manger, a trench at the rear of the stall for the reception of excrement, the rear wall of the manger preventing a stalled animal from stepping too far forward, and there are adjustable means for preventing the animal from stepping backward into the trench while occupying the stall.

APPARATUS FOR MAKING AND PACKAGING BUTTER.—J. DE LISLE, New York, N. Y. The object in this case is to provide an apparatus for making and packaging butter aseptically, that is, absolutely free from microbes liable to produce fermentation or putrefaction in the butter or disease in the intestines or other organs of the consumer of the butter.

Of General Interest.

EMBALMING INSTRUMENT. — T. F. RILEY, Troy, N. Y. The improvement is in instruments for use in draining the blood from the body in the process of embalming, and the purpose is to provide a device adapted to conform to the curves of the circulating organs, whereby it is possible to reach points ordinarily inaccessible and draw the blood off from two or more places simultaneously.

NON-REFILLABLE BOTTLE.—H. C. ANDERSON, Unionport, and F. S. ASH, New York, N. Y. The object of the invention is to provide a durable bottle from which the contents can be easily poured, which cannot be refilled after once being emptied by the ordinary methods, such as by force, submersion, or by the use of a vacuum, and the form of which does not differ radically from that of the ordinary bottle.

PICTURE-FRAME.—E. OLDENBUSCH, New York, N. Y. More particularly the invention relates to that type of frame commonly known in the art as a "shadow box." The frame is adapted to hold any form of picture, plaque, photograph, medallion, etching or the like, and is so constructed that the picture is spaced at a considerable distance back of the glass.

NON-REFILLABLE BOTTLE.—J. BIERNER, Elizabeth, and E. J. HEIL, Carteret, N. J. The aim of the improvement is to produce a bottle having a simple construction which will operate normally to prevent the bottle from being refilled, but which may be manipulated in such a way as to open readily to allow the liquid within the bottle to be poured out.

WATER-CURB-BOX LID.—J. J. HEIMBUECHER, Pittsburg, Pa. The lid comprises segmented sections hinged together at one edge, with fastening means at an opposite point and provided with depending hook-like lugs to underlie a flange on the box the sections combining to form a circular plate adapted to cover a curb box when the lid is lost.

FRAME-JOINT AND METHOD OF SOLDERING THE SAME.—L. B. PRAHAR, New York, N. Y. This invention relates to improvements in frame joints, and more particularly to a new method of securing together the abutting ends of metal channels going to make up the frame. It may be utilized in joints for bag jaws, picture frames, etc.

NON-REFILLABLE BOTTLE.—A. LA ROSE, New York, N. Y. When the device is ready for use the operator inverts the bottle in order to discharge the contents, and may remove the cap or not, as desired. The liquid finds its way out around the balls loosely mounted within the valve casing, as it has a clear open passage for this purpose. When, however, the bottle is placed in normal erect position the balls effectively seal the bottle and prevent entrance of any liquid.

Hardware.

HASP-LOCK.—P. MCMENAMIN, Jersey City, N. J. This lock may be generally defined as consisting of a staple or other keeper, a hasp pivoted to swing into and out of engagement with the keeper at one side of a plane passing through the keeper and the point of pivotal support of the hasp, and a lock to lock the hasp to the keeper, hinged to the lamp to move independently thereof to and from locking position at the opposite side of the plane when the hasp and keeper are engaged.

SQUARE.—T. C. HOWLAND, Long Branch, N. J. The arms of this square may be stamped out or cast from any suitable metal, and when assembled maintain their proper angular relation by providing one of the arms with a longitudinal channel having a branch at or near one end extending through the side edge of the arm, and with the bottom of the channel provided with a slot forming flanges, and the other arm having a portion closely fitting and conforming to the channel and the slot and seated on the flanges.

FAUCET.—H. FORSMAN, Fresno, Cal. An object of the inventor is to provide a device by means of which fluid can be drawn from a tank or other receptacle, and which simultaneously permits the introduction into the receptacle of an amount of fluid corresponding to that withdrawn.

Heating and Lighting.

BOILER-TUBE EXPANDER.—J. C. TASSEY, Nashville, Tenn. This expander is for use for pressing boiler tubes into boiler sheets. An important feature is the means whereby a cover sleeve fitting over beading rolls may be advanced over said rolls to bear against the flue sheet and permit the projection of the flue beyond the flue sheet during operation of expanding the wedges within the flue, after which the cover sleeve may be released and adjusted back over the rolls away from the flue sheet so the rolls may operate on the projecting portion of the flue to bead the same into engagement with the flue sheet.

VALVE.—W. SHURTLEFF, Moline, Ill. The aim of this inventor is to provide a valve, especially adapted for use with vapor heating apparatus for controlling the supply of vapor to the coils of the radiators, and wherein the size of the opening for admitting the vapor may be contracted or enlarged without the use of special tools.

Household Utilities.

ELEVATOR-CUPBOARD.—C. H. WELLER, Canton, Pa. In this instance the invention is an improvement in elevator or disappearing cupboards such as embody an elevator shaft frame in which the cupboard is vertically movable, the shaft frame being erected directly below an opening in the floor of the kitchen or other room where access to the cupboard is to be had.

WINDOW CLOTHES-LINE SUPPORT.—T. A. MACDONALD, Clifton, N. J. Mr. Macdonald has devised a support adapted for attachment to window frames by means of a universal joint whereby it is adapted to be swung into different positions as required to enable clothes to be easily placed on or removed from the line, and to be swung into horizontal position when not for use.

SUPPORT FOR SAD-IRONS.—G. ELLSTROM, Pittsburg, Pa. A hot sad-iron cannot be left standing for an appreciable time upon an ironing board without scorching the fabric upon which it rests. The invention gives a support for the iron while the user is spreading out the article to be ironed. When in non-service position the device is not cumbersome or in the way.

TRUCK STRUCTURE FOR GARBAGE OR ASH CANS.—M. T. LYON, Salt Lake City, Utah. The object of the invention is to provide a structure for garbage or ash cans which will enable the latter to be conveniently handled and transported from one place to another, as from a house to the alley, with little effort. In this structure the wheels are securely fastened to the body by simple means.

CHERRY-PITTER.—F. E. GREENE, Courtland, Cal. The object here is to provide a pitter that will remove the pits from cherries without mutilating the cherries. Another object is to provide a pitter which will remove the pits without punching holes through the cherries, thus saving considerable fruit.

Machines and Mechanical Devices.

ADVERTISING APPARATUS.—A. WEISMANN, Berlin, Germany. In this device an endless sheet bearing the advertisement is employed. It travels over rollers, the driving gear of which includes a clutch coupling and there are illuminating elements which are controlled by the actuating devices of the clutch coupling, for periodically lighting the advertising device.

PAPER-FEED FOR TYPE-WRITERS.—E. S. MANSFIELD, Atlanta, Ga. This improvement relates to a paper-feeding device for typewriters, and the object is to provide a device of this class which can be readily attached to a typewriter of ordinary construction, and which will operate to hold a number of sheets of typewriter paper and advance the same in succession to the platen.

VALVE.—W. N. LONG, Eugene, Ore. This valve is for use in flushing tanks. The valve has a cup movable in relation to an inlet pipe, this cup being provided with a hood for preventing excessive splashing of the water when the cup is raised for the purpose of allowing water, under considerable pressure, to refill the tank.

MECHANICAL STOKER.—T. V. ELLIOTT, New York, N. Y. This stoker is arranged to crush or reduce coal to a fine mesh, to distribute the reduced coal uniformly over the grate surface in the fire box, to insure proper burning of the fuel and complete combustion thereof, to agitate the grate constantly at slow motion with a view to keep the fire clean from dead ashes and prevent coking, and to automatically remove the ashes from the furnaces.

GEARING.—H. M. BAKER, JR., New York, N. Y. The invention refers to speed-controlled signaling mechanism, the more particular purpose being to provide a device in which a predetermined speed in a revoluble member forces into or out of action a visual signal so that a person may, by glancing at the signal, tell whether the speed is above or below a predetermined critical point.

AUTOMATIC SAFETY ELEVATOR-DOOR OPENER AND CLOSER.—F. F. BOYD, Philadelphia, Pa. The main object of this improvement is to provide a device which will be operated by the elevator itself to open the door when the elevator stops at the adjacent floor and to close it immediately when the elevator is moved up or down.

WATER-MOTOR.—W. J. WHITE, Oyster Bay, N. Y. The motor is adapted to utilize a small current of water having sufficient head so that a considerable power can be derived. The invention contemplates an arrangement of tanks or reservoirs in which the water level rises and falls continuously. Automatic means are provided for operating valves which control the flow through the reservoirs or tanks so that the motor operates continuously to develop energy.

COMBINATION LOCKING MECHANISM.—H. VAN HOEVENBERG, Lake Placid, N. Y. The invention refers to certain improvements in locks for boxes or other containers, and more particularly to that form of lock in which the two sections or parts, for instance, the box and cover, are rotatable in respect to each other, to operate the lock.

ORE-GRINDING MACHINE.—J. C. TATMAN, Denver, Colo. The object of the invention is to provide a machine arranged to provide a revolving velocity of the grinding wheels or mullers sufficiently high to take up and throw the wet ore particles at a tangent against the enveloping screen and to render the machine non-sliming.

REVERSING MEANS FOR SHAFTS.—H. F. SEYBERT, Perry Township, Pa. The invention pertains to certain improvements in reversing mechanism, and more particularly to means whereby the momentum of the engine while slowing down stores up energy to start the engine in the reverse direction as soon as it comes to a full stop.

PAPER-SLITTER.—S. M. LANGSTON, Camden, N. J. The machine is designed for cutting or slitting a strip of paper into a plurality of narrower strips and rewinding the narrower strips side by side upon a suitable reel. A special feature resides in the rewinding mechanism and the means employed for maintaining uniform surface friction upon the rewound strips during the entire rewinding operation.

SOUND-BOX.—W. A. CHAPMAN, Smithville, Ark. An object here is to provide a box for reproducing or recording the sounds by means of records, employed in phonographs, talking machines, etc., by means of which the sounds can be reproduced with clearness and distinctness, and with all their original tonal qualities, and in which the relatively movable parts are not subjected to excessive wear.

TYPE-WRITING MACHINE.—H. G. MCCOOL, Carmichaels, Pa. This inventor received former Letters Patent of the U. S. for a syllable keyboard for typewriters and typesetting machines, in which the keyboard has 192 keys, the same being arranged in twelve horizontal rows of sixteen keys each, and each key bearing three symbols, to wit, a single letter and two syllables of two and three letters respectively. By its use great speed is attained. The present invention is provided with such keyboard, or practically the same.

WIND-MOTOR.—R. F. E. OKRASSA, Antigua, Guatemala. The intention of this inventor is to provide a wind-motor, arranged to utilize the power of the wind to the fullest advantage, to hold the wind wheel accurately in the wind, to protect the wind wheel in case of storms and to properly transmit the power of the motor to other machinery.

MECHANICAL MOVEMENT.—W. S. ALLAN, Monterey, Mexico. The invention has reference to a suitable motion for the operation of a pump having two plungers working in one cylinder, one above the other, and is especially designed to be operated by a windmill or to be used as a pumping jack in connection with other power.

SAFETY DEVICE FOR ELEVATORS.—Z. T. DANSEY, Topeka, Kan. This device is particularly useful in connection with elevators operated by means of hoisting cables. By means of the device an elevator can be instantly brought to a full stop in case the hoisting cables or mechanism gives way, and which is directly controlled by the hoisting cables.

Prime Movers and Their Accessories.

DOUBLE-ACTING INTERNAL-COMBUSTION ENGINE.—H. O. HORNER and J. P. BOYLAND, New York, N. Y. In the present patent the invention is an improvement in double-acting internal combustion engines and belongs to that class of engines in which the driving-shaft is operably connected with the piston through slots in opposite sides of the cylinder.

STUFFING-BOX GLAND.—F. KEELER, White Plains, N. Y. The invention has in view a gland in which the sections interlock with each other and are held against relative movement in any direction, the bolts or studs for forcing the gland into the stuffing box also serving to force the inner end portions of the sections of the gland together.

Railways and Their Accessories.

MAIL-CATCHER.—A. M. BRIDGEWATER, Denver, Colo. The invention pertains to apparatus adapted to deliver and receive from railway trains mail bags and the like. It is a device in which the delivery means, both on the train and on the ground, is in the nature of a crane, and the receiving means is in the nature of a combined guide and receptacle.

TRACK-SANDER.—D. TAURIELLO, Newport, R. I. In the present patent the object of the inventor is the provision of a cheaply constructed and simple track sander for use with passenger cars, so arranged as to be conveniently operated and easily filled with sand, and which may be applied to existing cars with but little cost.

SLIDING-DOOR FASTENER.—F. J. S. MIELY, Gunnison, Colo. The fastener is designed more especially for box car doors which are mounted to slide and to swing outwardly at the bottom on the door hangers. The invention consists of door brackets, door-jamb keepers, a cross-shaft having eccentrics journaled in the brackets, and a hand lever to revolve the shaft into and out of locking engagement with the keepers.

STATION-INDICATOR.—E. L. PITTS, Yuma, Ariz. This invention relates to means for indicating the stopping places along railways, street car lines and the like, and the object is to provide a device which may be located in some conspicuous position which may be operated by the brakeman or other employee so as to indicate the next point at which the train will stop.

SCREENING-APPARATUS.—J. H. LYNCH, Haverstraw, N. Y. The invention refers more particularly to an apparatus designed for use in screening sand, gravel, coal, or the like, into two different grades and delivering each to a separate car or receiver. It is designed to be so mounted that cars may be run along separate tracks beneath the apparatus and as soon as filled, replaced by empty cars upon the same tracks.

Pertaining to Recreation.

BILLIARD-CUE TIP AND FASTENER.—C. MARX, New York, N. Y. In this instance the object of the invention is to provide a new and improved billiard cue tip and fastener for use on cues with or without ferrules, and arranged to securely hold the tip in position and to allow convenient replacing of a worn-out tip.

GAME APPARATUS.—H. O. SCHREIBER and C. A. GEISZ, East Liverpool, Ohio. This invention is an improved toy being in the nature of a miniature or table basket ball game. The board may be constructed oblong for two players or square, hexagonal or octagonal for four, six or eight players. The game may be played for goals and rules may be adopted to suit the players and copied from the basket ball rule book.

PISTOL.—M. J. SHIMER, Bethlehem, Pa. The invention provides a cap roll support at a point on the toy pistol such that the roll will be immediately accessible to and at all times within view of the operator, and, further, to so blanket the firing anvil when it is struck by the hammer that the possibility of flying fragments of the cap is eliminated.

Pertaining to Vehicles.

EMERGENCY WHEEL-RIM.—W. F. JENKINS and R. L. JENKINS, Richmond, Va. The invention relates to attachments for wheels using pneumatic tires, and is particularly applicable to the wheels of automobiles and similar motor vehicles. An object is to provide an auxiliary rim which can be attached to the rim of the wheel and which relieves the injured tire from the weight of the vehicle. An attaching means is provided so that the working parts are kept from rattling when not in use.

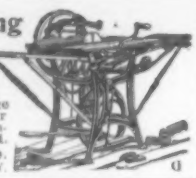
Designs.

DESIGN FOR A PLATE OR SIMILAR ARTICLE.—C. ZIEGLER, Limoges, France. In this design for a plate or similar article, the plate rim is octagonal in form, the various separated angles in which it is laid out being in two alternating lengths. A scroll work ornamental border runs around the edge of the article.

DESIGN FOR A QUILL-HOLDER FOR LADIES' HATS.—H. W. SCHWALB, New York, N. Y.—This design shows an ornamental quill holder. The article is flanged at the top and narrows almost to a point at the bottom, the whole taking a semi-circular form with two different patterns for graceful ornamental effect.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Wood-working Machinery



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Scientific American Supplements 1565 and 1569 present a helpful account of the making of concrete blocks by Spencer Newberry.

Scientific American Supplement 1534 gives a critical review of the engineering value of reinforced concrete.

Scientific American Supplements 1547 and 1548 give a resume in which the various systems of reinforced concrete construction are discussed and illustrated.

Scientific American Supplement 1564 contains an article by Lewis A. Hicks, in which the merits and defects of reinforced concrete are analyzed.

Scientific American Supplement 1551 contains the principles of reinforced concrete with some practical illustrations by Walter Loring Webb.

Scientific American Supplement 1572 contains an article by Louis H. Gibson on the principles of success in concrete block manufacture, illustrated.

Scientific American Supplement 1574 discusses steel for reinforced concrete.

Scientific American Supplements 1575, 1576, and 1577 contain a paper by Philip L. Wormley, Jr., on cement mortar and concrete, their preparation and use for farm purposes. The paper exhaustively discusses the making of mortar and concrete, depositing of concrete, facing concrete, wood forms, concrete sidewalks, details of construction of reinforced concrete posts.

Each number of the Supplement costs 10 cents.
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Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12163) J. V. S. says: Kindly help us in an argument. We agree upon the fact that the upper part of a wheel travels faster than the lower part when the wheel is pushed along a road. Kindly state if the same conditions do not prevail when the wheel is driven from the center, as is the case with the rear wheel of an automobile. A. The motion of a wheel is exactly the same, whether driven in one way or another, from the center or dragged by a horse. It simply turns around the axle. The angular velocity of every part is the same as measured from the center line of the axle. Since the part of the wheel in contact with the road is at rest on the earth or rail, the top of the wheel is moving twice as fast as the hub, as referred to the point of contact with the earth. We have fully discussed this in Answers to Queries, Vol. 92, Nos. 16, 20; in the Correspondence Column of Vol. 92, No. 25, and in Vol. 96, No. 6; price 10 cents each.

(12164) J. T. S. says: Will you kindly tell me how I can improve the acoustics of my recitation room? It is 67 feet long, 30 feet wide, and the ceiling is 18 feet high. There is nothing in the room but the recitation tables, a blackboard, and fifteen electric light drops hanging from the ceiling. The room echoes so, it is almost impossible to carry on a recitation, or hear anyone speak. A. Your case is a difficult one; the room is as badly proportioned as it can possibly be. It would be much better if it were divided into two rooms by a partition across the middle of its longer dimension. It is more than twice as long as it is broad, a tunnel in fact. The usual remedy for echoes is to hang soft curtains or other drapery upon the walls, to interfere with the reflection of the sound waves. This would doubtless cure your room, but the cure is expensive.

(12165) J. H. B. says: 1. What is the highest resistance that an ordinary dry cell can overcome? How much current will an electromagnet wound to four ohms resistance use? Also, will one wound to twenty ohms use more or less current? A. The current which a dry cell can send depends upon the resistance of the circuit in which it is placed. The voltage of a dry cell should be about 1.4 volts. Against a resistance of 4 ohms, this cell can send about 3 amperes, found by dividing 4 by 1.4. This is in accordance with Ohm's law. If the resistance is higher, the current is less. If there are 20 ohms, the current will be only a fifth as much as with 4 ohms. A dry cell can send a current which can be detected by a delicate instrument even when the resistance is many hundred ohms. That depends on the sensitiveness of the instrument. 2. What size wire and how much will be required to wind a magnet of four ohms resistance? A. The size of wire for an electromagnet must be selected for the current which is to be used in the magnet. If you use No. 24 wire, you can take 40 feet to the ohm. 3. What is the best way to make and charge a permanent magnet? A. To make a permanent magnet get a piece of good steel—tool steel is ordinarily used—and harden the ends glass hard. Then draw the bar across and off from the pole of a strong magnet. It will be magnetized, so that the end of the bar which leaves the magnet last will be a pole opposite to that of the magnet. The bar should be drawn across the magnet pole 15 to 20 times.

(12166) J. H. C. says: Steel resists the power of magnetism more than soft iron, and heat destroys the magnetism of a steel magnet. Now suppose you heat a piece of magnet steel and temper it properly while in a powerful magnetic field; will the point of magnetic saturation be raised or lowered, or will it be the same as if magnetized at ordinary temperatures? A. If steel is heated till its magnetism is destroyed, and then tempered in a strong magnetic field, its magnetism will be restored; and if the field is strong enough, the bar will be saturated. The degree of magnetism which constitutes saturation will not be affected by such treatment. Saturation depends upon the kind of steel and the magnetic force to which it is subjected.

(12167) H. A. B. says: 1. Would you kindly tell me how large a spark would a Wimshurst influence machine give which has 16-inch plates, each having 16 segments on them of tinfoil? A. A static machine, Wimshurst or Holtz, may give a spark as long as the distance between the sectors at their nearest points across the axle. Without Leyden jars the spark is a thin blue line. With the jars the spark is shorter, but far more intense. It is the spark due to the heavy discharge of the jars. 2. Could I increase the length of the spark by Leyden jars or by adding more segments to the plates? A. You have the proper number of segments upon your plates at present. You will find in our Supplement Nos. 278, 279, 282, valuable articles upon the Holtz machine, with many experiments; and in Supplement Nos. 548, 584, 647, 914, 943, 1131, valuable articles upon the Wimshurst machine. We will send the papers for ten cents each.

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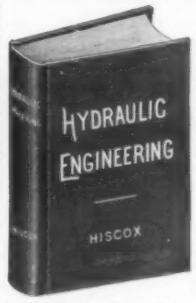

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All who are interested in water-works development will find this book a useful one, because it is an entirely practical treatise upon a subject of present importance, and cannot fail in having a far-reaching influence, and for this reason should have a place in the working library of every engineer.

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While more than half the work is devoted to wiring and related subjects, there is a good deal of other information that will be found generally useful. There is a chapter on incandescent lamps, which includes tabulated data on this topic. Switchboards of the various types, their design, etc. are considered in three chapters, and the accompanying diagrams are clearly executed and easily understood. The remaining chapters briefly review the nature and characteristics of alternating currents, and their practical application is described. It is in every respect a handy, well-written, instructive, comprehensive volume on wiring for the wireman, foreman, contractor or electrician.

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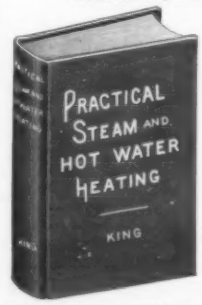

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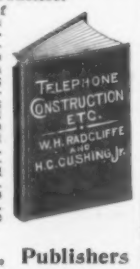
Intricate mathematics are avoided, and all apparatus, circuits and systems are thoroughly described. The appendix contains definitions of units and terms used in the text. Selected wiring tables, which are very helpful, are also included.



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MECHANICAL BOWLING MACHINE.

(*Concluded from page 24.*)

trifugal force effected by the band, causes the ball to swerve during its flight. In this operation, though the hand is revolved, the drum upon which the ball rests in the palm or cup is stationary. This device is brought into action when it is desired to give the ball a "spin." There is a groove in the drum in the palm over which a band is passed, and which by suitable arrangements is carried to the same points as the "swerve" pulleys. For imparting a pure spin to the ball, the pulley rotating the hand as above described is thrown out of action, and simply the drum in the palm upon which the ball rests revolves during the travel of the arm on an axis parallel with the drum and at right angles to the line of flight instead of revolving on an axis parallel with the line of flight, as in the action to produce swerve. If desired, both actions can be brought into use at the same time, and then the ball is given a compound or refractory gyration—a combination of swerve and spin—which delivery puzzles the most accomplished batsman because of the erratic and constantly varying rotary axis of the ball.

The device is aptly suited for practising purposes. The velocity of the ball can be altered at will, and there is a "velocemeter" mounted on the machine to indicate the exact momentum during flight. The variations possible are very extensive, and no two successive balls need be delivered alike, the change being effected without the batsman being aware of the fact, or if desired a certain type of delivery can be repeated *ad lib.* Every gyration can be adjusted as desired, and indeed it is possible to mechanically reproduce the deliveries of any particular bowler. The "break," i. e., the tangent to right or left produced when the ball strikes the ground, is measured by a graduated sight, which also indicates the swerve of the ball to one side or the other during flight. Similarly, the ball can be made to leave the "hand" at any point of the arm's travel, there being a series of stops to secure this end. In this manner the pitch of the ball, that is the distance from the machine to the point where it comes into contact with the ground, can be easily varied, and similarly the ball can be made to strike the ground in such a way that after the impact it shoots forward at great speed.

The machine is mounted on telescopic legs, and the height of the delivery of the ball can be made to coincide with that of any bowler whom it is desired possibly to imitate, the variable range being from six to eight feet above the ground. The mechanism is also arranged to swivel on its body, so that the bowling arm can be pointed in any direction without moving the body. The arm is brought to the horizontal position by means of a lever, by which it is also trained and released, and at the same time a disk is raised to warn the batsman of the impending delivery. Every ball delivered is moreover registered automatically upon a dial.

AUTOMATIC RAILWAY SAFETY STOP.

(*Continued from page 25.*)

duced the locking wedge into its normal position.

The remarkable safety of this apparatus is mainly based on the considerations: (1) The locomotive personnel is warned in a triple manner on a closed signal being passed over, viz., (1) by a siren (2) by a warning disk, and (3) by the brake being actuated. (2) The train is stopped: (1) By ordinary braking (in the case of preliminary signals), (2) by high-speed braking (in the case of main signals with two pairs of contacts). (3) The question as to whether the locomotive personnel line men or station personnel, are guilty, will be fully indicated by the dash and dot records. (4) The track contacts which are only 3.5 kilogrammes in weight, are extremely easy to transport and are readily installed at

(*Concluded on page 36.*)

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(Concluded from page 35.)

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GRAPHITE MINING IN CEYLON.

(Continued from page 29.)

not be determined without further examination. Much smaller quantities of graphite occur as flakes in many of the granulites and in the crystalline limestones, when it invariably forms small tabular six-sided crystals with well-developed basal cleavage. In these cases, according to Dr. A. K. Coomaraswamy, the director of the Mineralogical Survey, the graphite behaves like the other accessory minerals, and there is no reason to suppose that it has been subsequently introduced.

Evidently the graphite in the veins has been deposited at a time posterior to the consolidation of the granulites, and they are of the most typical character. Usually they consist of pure graphite with occasional evidences of more than one period of deposition in a zoned structure of the vein. Metamorphism of the surrounding rocks near the veins is found on only a small scale, the rock surfaces in immediate contact with graphite being impregnated with the carbon no more than about half an inch. Neither are the quartz and other minerals associated with the graphite vein filled with disseminated graphite, the latter occurring only in strings filling cavities or cracks in the quartz. It is evident that the deposition of the graphite must have been from vapors or liquids saturated with mineral (carboniferous) matter.

The best producing districts are Kegalla, Ruanwella, and Pasdum, but areas are found over the island with the exception of the northern and eastern portions. The mining is almost exclusively in the hands of the natives, and primitive methods obtain. There are but little organized means of prospecting. A villager stumbling across evidences of graphite immediately completes arrangements for working it. A pit is sunk until the vein or deposit is gained, and the mineral extracted until the yield fails. When walking through plumbago areas, numerous abandoned shallow pits may be seen alongside the roads.

In the richer districts more methodical working is adopted, but even here there is a quaint antiquity about the mining equipment. The pit rather resembles a fissure in the rocks than a symmetrical excavated shaft. At the top a heavy staging or platform is erected, from which extends downward to the working levels a crude ladder fashioned from lengths of bamboo secured together to form a continuous run with coir or native made jungle rope. The transverse sections forming the steps are likewise made from pieces of bamboo similarly secured to the side members and spaced somewhat widely apart.

In many instances the ladder comprises sticks of bamboo extending across the width of the fissure and imbedded in the earth on either side ranged at a slight angle, so as to give the impression of an inclined plane of steps. The bamboo sticks are rough, and being spaced widely apart are somewhat difficult to negotiate to aught but the lithe native. Moreover, the countless journeys made by the natives with their loads of graphite have resulted in these steps becoming coated

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(Continued on page 38.)

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1. *The Automobile and the Farmer.*
2. *How to Overhaul Your Car.*
3. *The Automobile Fire Engine.*
   All the latest automobile pumping engines, chemical cars, hook and ladder trucks, and hose carts are described.
4. *The Automobile and the Road.*
   The automobile has presented to the road engineer new problems for solution. He must render his roads impervious to water and practically proof against the destructive effect of tires. The United States Government through the Office of Public Road Inquiry is now studying this subject. The article written by Mr. Page, Director of the Office of Public Roads, describes what has been done.
5. *Anti "Joy Ride" Devices.*
   This article is a complete description of devices which have been invented for the purpose of preventing chauffeurs from taking out their owners' machines.
6. *The Modern Electric Automobile.*
7. *Making Your Own Repairs.*
8. *The Cars of 1910.*
9. *Automobile Identification Chart.*
   Sometimes you have wondered what make of car was that which skimmed past your admiring eyes. The 1910 Automobile Number will enable you to identify any car by its radiator and engine bonnet. About thirty-five automobiles are thus illustrated for identification in a sketchy, artistic way.
10. *The Inexpensive Car.*
    Any man with a good salary can now afford to own some kind of an automobile. How the machines are constructed and what may be expected of them is lucidly set forth.
11. *The Wonderful Rise of the Automobile Industry.*
12. *Automobile Novelties.*

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(Continued from page 36.)

with the mineral, which under the friction of the bare feet has a most brilliant polish and is dangerously slippery, except to the active movements of the miner.

The graphite is excavated by equally crude tools; and instead of being hoisted to the pit mouth by rope and pulley, is loaded into tall baskets of native manufacture, resembling small barrels, loaded on the shoulders of the native, who carries it bodily up the long ladder to the pit mouth. As a result, in a busy pit there is a constant endless train of ascending and descending natives bearing their baskets swarming up and down like flies, their bodies covered with plumbago brightly polished, giving them the appearance in the sunlight of moving figures wrought in bright steel.

Should the pit become flooded a simple system is adopted. A rude conduit formed of lengths of wood placed diagonally together so as to afford a V channel is improvised, which leads to a lower level, a small orifice being bored through the side of the pit if necessary to secure the outlet. The water is baled out by natives equipped with small vessels.

At one or two of the pits where the veins are abnormally thick, some pretense to modern mining methods is made, The water is removed by the aid of steam pumps, and the native carriers are displaced by power hoisting plants hauling the mineral from a depth of four or five hundred feet to the surface. At Pelawatta, the most extensive workings in the Pasdun korale, such an installation has been laid down, and here the prevailing conditions warrant the outlay for such machinery, since one main vein striking north and south has a maximum thickness of twelve inches.

Owing to the heavy demand for graphite that ensued as a result of the South African war, when $315 per ton was realized, a plumbago fever broke out among the natives. Such a price induced individual working and illicit mining on crown lands. Even to-day the latter traffic takes place. Should the mineral be proved to exist on the government property, licenses are duly issued by the authorities to respectable individuals to exploit the deposits, but the natives resort to poaching.

The graphite as it is mined is taken to the cleaning and grading works. It is first submitted to a preliminary hand selection; all the large pieces, which are for the most part pure graphite, or are associated with pyrites and selenite, being placed on one side. The sieves comprise screens of varying mesh stretched on wooden frames inclined at an angle, over which the mineral is emptied from small shallow baskets and then rubbed by hand, the larger or coarser pieces falling to the base of the screen, while the minute particles pass through the meshes. This process is repeated several times, work being commenced first on the smallest meshed screens. In this manner the dust and much of the friable loose earth is separated. This phase of the work is carried out by women and children.

Sifting completed, the graphite then undergoes cleaning. The product being brought in from various localities may be found associated with other matter such as ironstone or carbonaceous deposits of various descriptions, and this deleterious material is removed by hand. This operation also serves to separate the mineral into two qualities, the market price of which averages from $175 to $200 per ton for the first, and from $50 to $125 per ton for the second grade.

The industry has attained great prosperity, upward of 30,000 natives being employed in the mining of the article, the value of which production considerably exceeds $5,000,000 per annum. The industry is also for the greater part in the hands of the natives, many of whom have amassed considerable fortunes, since owing to the cheapness of the labor, ample supplies of which are readily avail-

(Concluded on page 39.)

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

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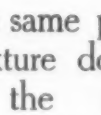

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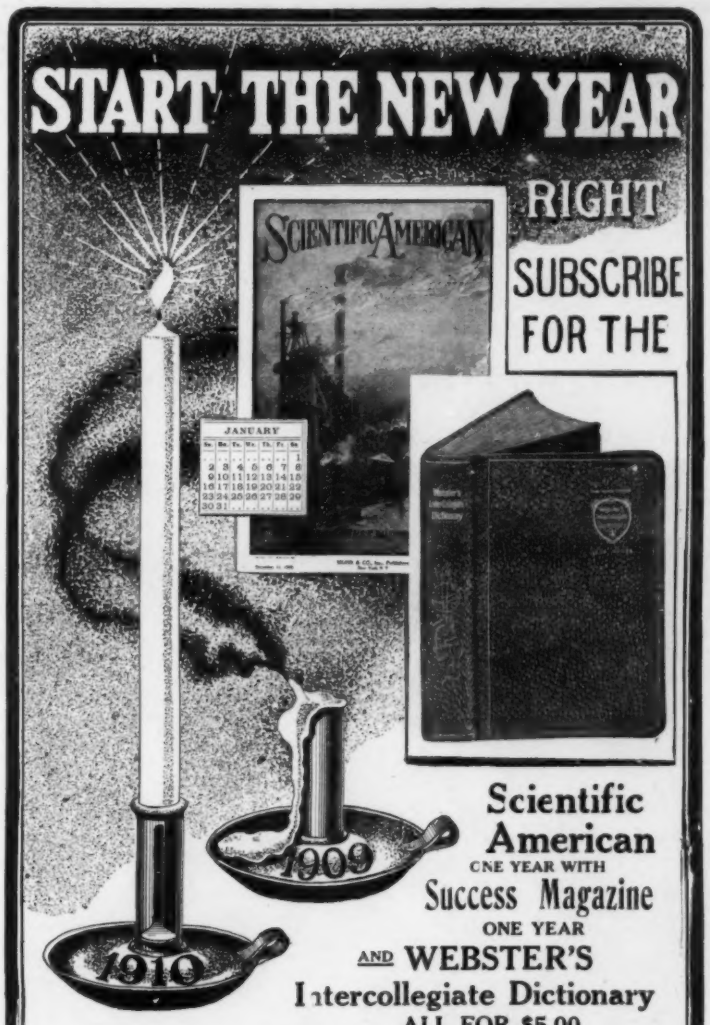

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About a year ago it was decided to open a department in the Scientific American devoted to the interests of the handy man. There was an almost immediate response. Hundreds of valuable suggestions poured in from every part of this country and from abroad as well. Not only amateur mechanics, but professional men as well were eager to recount their experiences in emergencies and offer useful bits of information, ingenious ideas, wrinkles or "kinks," as they are called. Aside from these, many valuable contributions came from men in other walks of life—resourceful men, who showed their aptness at doing things about the house, in the garden, on the farm. The electrician and the man in the physics and chemical laboratory furnished another tributary to the flood of ideas. Automobiles, motor cycles, motor boats and the like frequently call for a display of ingenuity among a class of men who otherwise would never touch a tool. These also contributed a large share of suggestions that poured in upon us. It was apparent from the outset that the Handy Man's Workshop Department in the Scientific American would be utterly inadequate for so large a volume of material; but rather than reject any really useful ideas for lack of space, we have collected the worthier suggestions, which we present in the present volume. They have all been classified and arranged in eight chapters, under the following headings:

I, Fitting up a Workshop; II, Shop Kinks; III, Soldering of Metals; IV, The Handy Man in the Factory; V, The Handy Man's Experimental Laboratory; VI, The Handy Man's Electrical Laboratory; VII, The Handy Man About the House; VIII, The Handy Sportsman; IX, Model Toy Flying Machines. Index.

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(*Concluded from page 37.*)

able, while the capital outlay is small, a handsome profit is secured. The industry is however somewhat controlled by the government, which levies an export duty of about $2 per ton, representing an annual contribution to the revenues of the island of about $100,000. The increasing extension of crucibles in the metallurgical industries, and the resultant increased demand for graphite, is responsible for the present flourishing condition of the industry.

Woven Aluminium.

Aluminium, as is well known, is extracted from clay and it was Napoleon who styled it the "silver of clay." Formerly, it was the practice to extract it from the clay with the aid of retorts. More recently, the electrical current is employed for this purpose with marked success, the cost of producing this valuable and by no means fully utilized metal, having by its employment been very much reduced. In 1850, a pound of aluminium cost about $40; nowadays it costs only about 20 cents. Above all other metals, aluminium has the greatest specific lightness with the greatest durability and toughness. It can be rolled, cut and drawn exceedingly fine. This has made aluminium valuable and useful in the textile industries. For many years, woven sieves or screens have been made of aluminium, which have proved indispensable in the sugar refining industry. Its principal advantage consists in the fact that the surface of the aluminium, on the slightest exposure to the air, becomes covered with a coating of oxide which is capable of offering almost perfect resistance to foreign influences, such as acids, etc. This is likewise of great importance where aluminium is used in the textile industries.

Speaking of actual weaving of aluminium into special fabrics, particularly such as are intended for use for decorative purposes and costumes, it may be stated that this is well and successfully practised in England. At the time of the Paris exhibition, there were shown, as special attractions, fabrics and clothes made from glass fibers. They were made from finely spun glass, with silk. The fabrics made from aluminium do not need combination with other textile yarns. Of late, the most beautiful effects have been obtained by employing aluminium in smooth as well as twisted threads for the warp, and as the weft, silk yarn of any desired color. They are used for evening cloaks and theatrical costumes. As the Textil-Woche says, it makes the body of a beautiful woman look as though dipped in silver. From aluminium, they are now making neckcloths, pompadours, shoes, belts, neckties, shawls and hats, and it is hard to prescribe a limit for the possibilities of this metal. Very striking are net fabrics in combination with aluminium, which constitutes a select novelty for interior decoration. Aluminium yarn, made up into laces for ladies' shoes, as well as used for straps, promises to be a feature of the coming season.

It would be quite an advantage to the motorist, states a contemporary, if he could communicate by wireless telephone with his garage or the nearest repair shop in case of accident. An American inventor, who is developing a system of wireless telephony recently made experiments with portable apparatus to determine the range of service of the instrument. He was able to communicate over a short distance with a garage in Newark, but at a distance of eight miles the apparatus failed. Apparently wireless telephony will have to be developed far beyond its present efficiency before it can be of service to the motorist. The chief difficulty is that only a short transmitting antenna can be used, requiring an enormous expenditure of energy to reach a city garage, because of obstacles in the way, such as steel buildings, trees, wires, etc.

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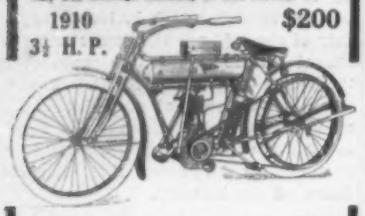

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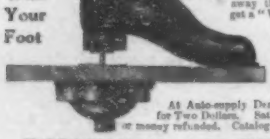

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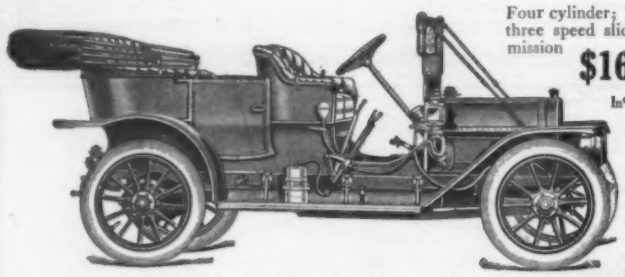

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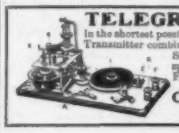

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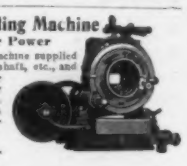

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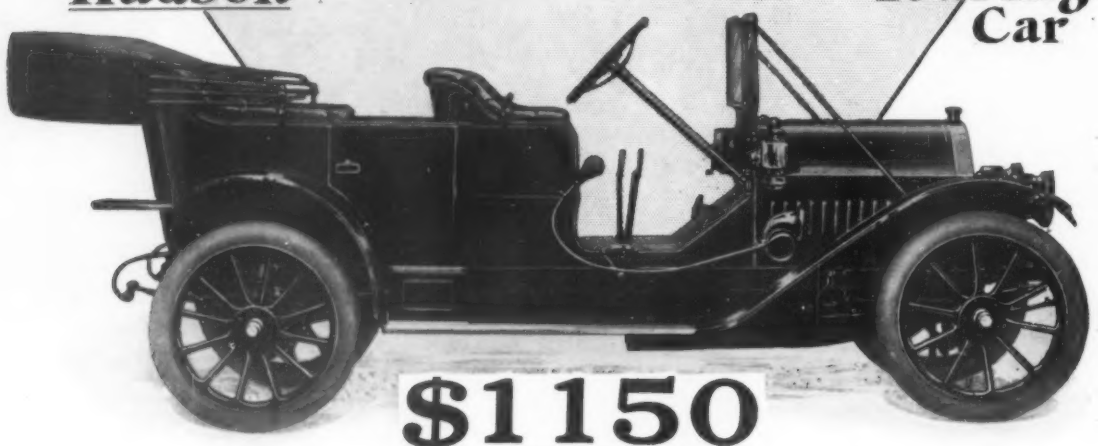
January 15, 1910

MUNN & CO., Inc., Publishers
New York, N. Y.

Price, 10 Cents

The Hudson Touring Car



$1150

"Look for the Triangle on the Radiator"

This price includes three oil lamps, two gas lamps, generator, horn, tire repair outfit, tools and jack.

Strength—Room

Think what this car is—110 inch wheel base; four cylinder motor; 32 inch wheels; 3½ inch tires all around; five passenger capacity—and the price $1150.

Never before has there been offered such a car at such a price. This is not just a hasty statement of our own. Can you think yourself, of any other four-cylinder, 110 inch wheel base, five passenger car at $1150 or less?

You will find these features in other cars, but those cars sell for at least $100 or $200 more. You will find still other cars selling for less than $1150, but they do not have our high grade features. The Hudson Touring car is the best **value,** the best **buy** yet offered by any automobile manufacturer. By this, we mean you get relatively more **for your money** than in any other car.

Beauty—Refinement

There are certain proved features of motor car construction which any car must have before it can be considered an up-to-date, high-grade car.

The Hudson has those features. To those makers who show you the same features, we point to our price; it is lower than their's. To those who offer cars below $1150, we point to our high-grade features; they do not have them.

From one class we are set off by our price; from another by our quality.

The Hudson is *strong*, because the careful plans of a great engineer have been expressed by the best material that money can buy.

It has plenty of *room*—many cars are big and heavy without being roomy. The Hudson is big and roomy without being too heavy.

The Hudson has *beauty*—not merely the beauty of paint—but the beauty of balance, of perfect proportion. Many touring cars look "bunched." In the Hudson over-all length, hood, body, wheels, harmonize to make a whole effect that pleases the eye.

No other touring car at or near the price has so many features and refinements in common with the most expensive cars.

High Grade Hudson Features

Its motor is the Renault Type, patterned after the famous Renault motors of France. It is the same type of motor as used in the Hudson Roadster; four cylinders "en bloc;" vertical, water cooled, long stroke, 20 to 25 H. P. Due to its long stroke this motor pulls quietly and evenly at low engine speeds.

Transmission is selective, sliding gear; three speeds forward and one reverse—the same transmission as found on the highest priced cars.

The spring suspension is the same as used on cars costing up to $6000. Semi-elliptic front and ¾ elliptic rear, unusually long, mounted with heavy, strong fittings. Clutch is leather faced cone type; rear axle semi-floating, shaft driven. Front axle "I" beam section, drop forged, of carefully selected, high grade steel.

There is nothing experimental about this car—nothing untried. No low-priced touring car is so near mechanically perfect.

Hudson Refinements

When we say the Hudson has refinement, we mean that many little things, of small importance, one by one, but meaning in their total, comfort and satisfaction to the owner, have been put into this car.

See how the rear fenders are inset against the body; how the fenders throughout are absolutely mud-proof. Inset fenders are a feature of very high-priced cars.

The unusual leg room and big 18 inch steering wheel mean *comfort*. No standard touring car at any prices provides as much leg room as the Hudson.

Doors are big, hung on heavy curved hinges, allowing maximum entrance and exit space.

The Toe boards, spring steps and running boards are beautiful aluminum castings. No bolts show through the foot board, nothing to catch a dress or coat or look unsightly. The floor board is covered with pyramided white rubber of best quality, except where driver's heels rest and this part is reinforced by an aluminum plate.

The foot accelerator is something entirely new in design and does not tire the foot.

The body is built with wheel-housing, that is, the body curves out over the rear wheels, allowing a big, comfortable, roomy tonneau. Car is finished and upholstered like the best.

Why you get more value in a Hudson

We have been asked how we can give so much for the money and our answer is: Because we know how. Two engineers could undertake each to build a railroad from New York to Chicago—roads to be of equal length; one man would build a better road for the same money than the other, or the same road for less money than the other. It is so in the automobile business; one set of men will build a better car at less money than another. It is simply a question of ability.

The Hudson will exhibit at the Madison Square Garden and Chicago Shows.

See this car—ride in it—compare it with other cars and you will say that no matter just how we do it, the fact remains that we do give the most at the price.

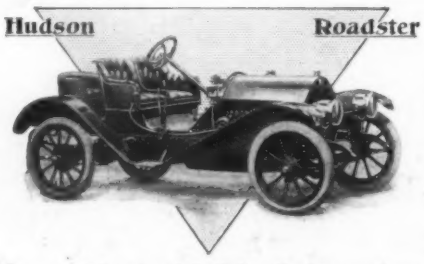
This also holds true of Special equipment. Think of a Bosch Magneto, Special Brookfield Top, and Trunk Rack, all fitted on the car for $125 Extra.

Mailing this coupon to-day will bring you our catalogue and complete information about both the Hudson Touring Car and Hudson Roadster.

CUT OUT AND MAIL S. I.

Hudson Motor Car Co.,
Detroit, Mich.
Mail New Hudson catalog to

Hudson Roadster



January 1st the price of the Hudson Roadster was increased to $1000. This includes 32x3½ tires *front* and *rear;* three oil lamps; two gas lamps; generator; tire repair kit; tools and jack.

The Hudson Roadster is America's biggest, best looking and best built low-priced car. Several thousand of them are in the hands of owners and giving complete satisfaction.

The Hudson won a 24-hour race in Seattle in September, defeating many high-priced cars. This was its first race.

Mr. E. H. Nelson, a prominent business man of Detroit, drove his Hudson car from Detroit to New Haven, Conn., at an expense of less than one cent per mile for oil and gasoline and without making a repair.

Mr. Geo. D. Smith drove a Hudson Roadster from Long Island, N. Y., to Pleasant City, Fla., without touching a bolt, nut, spark plug or making a mechanical adjustment.

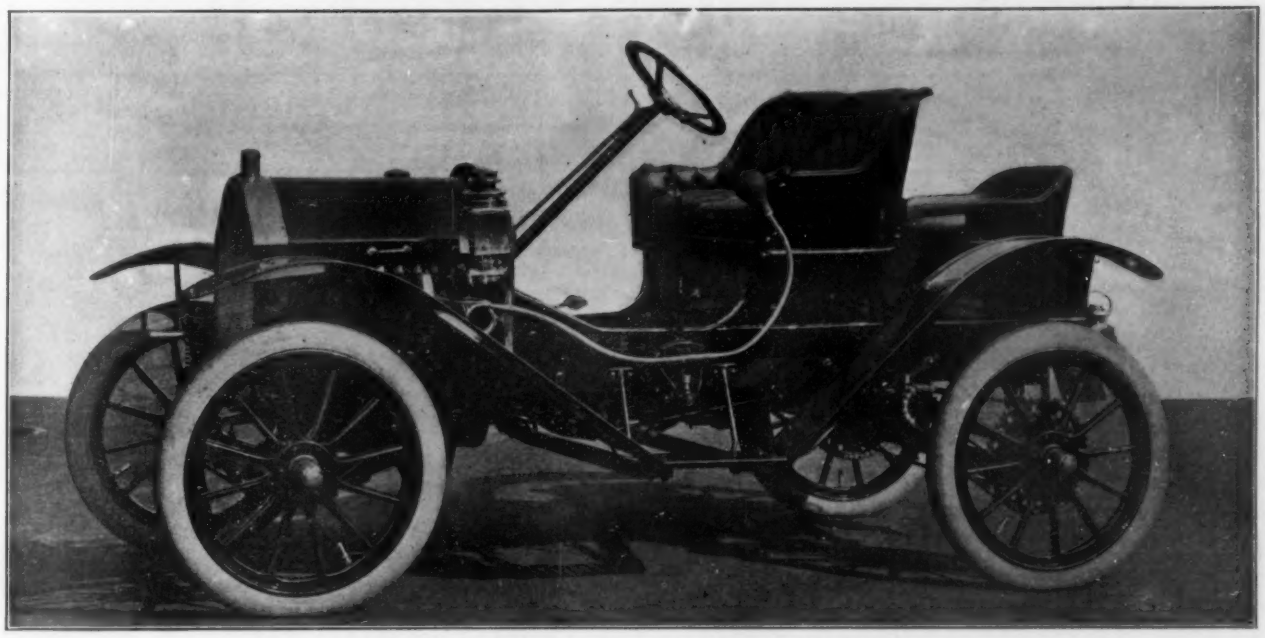
Three important facts are brought out in hundreds of testimonial letters received from Hudson owners: "Low gasoline and oil consumption"—"Wonderful mechanical efficiency"—"It rides as easy as the most expensive cars."

Remember the Hudson Roadster is not an imitation of a big car—it is a big car. It is big in design, in material, in general all-around value. Look at our price on extra equipment. Bosch magneto, Arden top, Presto-lite tank and rumble seat for $150 extra.

Hudson Motor Car Company, Detroit, Michigan

Members A. L. A. M. *Licensed under Selden Patent*

Everyman's Car at Last
1910 BRUSH $485.00



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Suburbanites

The Young Folks—

The Brush knows no class; there is no limit to its usefulness. A tried, proven automobile for less than the cost of a good horse and buggy.

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Think of it—$485 for the best-built, most thoroughly proven, easiest riding, most economical, handiest small automobile in the world!

THE NEW BRUSH RUNABOUT not only outclasses all small cars, but is far ahead of its own previous high standard.

Even though we have learned the lessons all manufacturers have to learn by experience—even though we have manufacturing facilities as nearly perfect as money and brains can make them—still we could not build a car of the quality of the 1910 Brush if we merely imitated the big cars with all their complicated parts and all parts necessarily smaller and weaker.

Here's where the genius of the designer counts.

The Brush has always been and still is the only real Runabout built in America.

The new 1910 Brush is not a designer's dream but the result of years of experience and a knowledge acquired by manufacturing 3,000 Brushes that are in daily use. It is a car which with one chassis adapts itself perfectly by change of bodies to a hundred different uses.

It is a car new in power, smoothness, speed and looks but built on proven principles by an organization already perfected.

The Brush has the fewest possible parts but they are of sufficient size and strength to stand the hardest knocks.

SIMPLICITY makes it possible to build the car right and still sell it at this wonderful price.

As for reliability there is no comparison between the Brush and any of the small imitations of large multi-cylinder cars.

With the new Brush you get single-cylinder simplicity, reliability, light weight, low gasoline and oil consumption, low tire expense with four-cylinder power and smoothness.

Its new balanced motor runs as quietly as a four-cylinder and is as flexible. Its power is astonishing.

The most wonderful improvement in Motor Car construction in years.

While the balanced motor is the most remarkable feature of the 1910 Brush, we have made numerous other improvements and refinements.

Here are some of them: wheel-base lengthened 6 inches; more graceful and rakish lines; Mercedes type radiator; new selective control; universal coupling-shaft; improved dust-proof commutator; multiple disc low and reverse clutches; transmission control levers entirely housed and oil-tight; more quiet muffler.

In our magnificent new plant we make every part of the Brush except the wheels, tires and electric equipment. The Brush buyer pays no middleman's or parts-maker's profit.

READ THE SPECIFICATIONS

Motor—10 H. P., *balanced* single cylinder, four-cycle, vertical, 4" x 5", water cooled; located in front under hood; every part instantly accessible; three point suspension.

Balancing—After balancing by the usual counterweights, one extra loaded balance gear, driven by a crankshaft gear, is applied, the result of which is to take out *all* of the vibration due to reciprocating weight and in addition *most* (or at times *all*) of the torque vibration—theoretically *in better balance than a four-cylinder motor.*

Transmission—Internal gear type, perfectly quiet; entirely enclosed and absolutely oil-tight.

Cooling—Mercedes type radiator, on Briscoe thermo syphon system, eliminating pump.

Drive—Double side chains to rear wheels.

Control—Single hand-lever of selective action for all speeds; spark and throttle under steering-wheel; foot-pedal releases clutch without touching the hand-lever, and also applies the brake. This clutch release by the foot is one of the fine features of the Brush and is found on no other low-priced car.

Steering Gear—Another exceptional feature; internal reducing spur gear, slow and powerful at straight-ahead and accelerating as the wheel turns; entirely enclosed and oil-tight.

Axles and Frames—Oil-treated, selected wood, oak, hickory and maple; wonderful for strength, durability and lightness.

Springs—Spiral, located at extreme four corners; absolutely the easiest riding springs on any car and mechanically impossible to break.

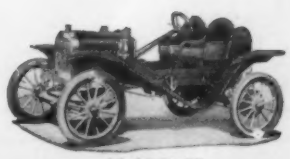
Brakes—Internal expanding in rear sprocket hubs.
Wheels—Artillery, with 28" x 3" pneumatic tires.
Wheel Base—80 inches.
Tread—56". For Southern trade 60".
Equipment—Tools, tire kit, 3 oil lamps, horn.
Color—Maroon, except coupe.

Body—Divided seat; trimmed in high-grade leather. Platform on rear, as pictured above, with equipment $485.00.

Six special bodies, furnished on order, at extra prices, as follows: rear platform with steel tool box; rear compartment with removable steel deck; single or double rumble with wooden tool box; racer type; coupe.

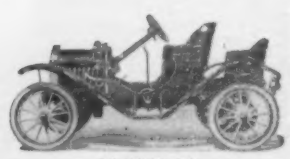
Speed—35 miles an hour, except racer type, which has special gearing.

BRUSH RUNABOUT COMPANY, 167 BALTIMORE AVENUE DETROIT, MICHIGAN



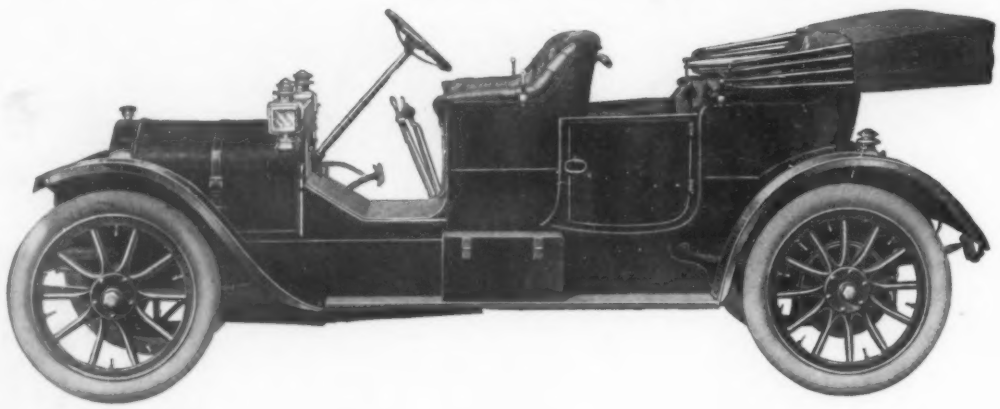
Model D 28

Model D Coupe



Model D 26

THE WHITE GASOLINE CAR
is in a class by itself



If you plan to buy a gasoline car, why not get the very latest construction? You can find it only in the White, or in the 1910 foreign cars at double the White price.

The White gasoline car is at least one year ahead of any other American-built machine. Some of the advanced features of the White, which are not yet found in any other American car are:

"Long stroke" engine
No external manifolds
Heated intake
Water-cooled exhaust

Among the White features which are not found in any other American cars, except those of the highest prices, are:

Four-speed transmission
Imported cylinder casting
Bosch magneto

The above features, combined in good design with the best materials which money can buy, and with the famous White workmanship make the White gasoline car by far the most desirable on the market.

We venture the prediction that the principal changes which will be made by progressive American manufacturers during the next year or two will be the adoption of the features which are found *now* in the White gasoline car.

The price of the White gasoline car ranges from $2,000 for the Model "G-A" touring car to $3,800 for the Model "G-B" landaulet.

Even if you desire a smaller car or a larger car than the White, it will be to your advantage to inspect the White or at least to write to us for a copy of our catalog, in order that you may inform yourself as to the latest developments in gasoline car design.

A POSTAL TO US BRINGS A COPY OF OUR CATALOG

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